AMERICAN MACHINIST

May 17, 1939

Loudspeaker—*Caterpillar Tractor promotes better public relations by equipping shop guides with voice boosters so they can be heard above machine noises (page 329)*

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Snow Ball . . .

Once we had a big lathe hand with an unpronounceable last name, but it didn't much matter, because everybody called him "Snow Ball" anyhow. Snow Ball roughed down castings, and got his nickname from his habit of running his dirty hands over his face, until by ten o'clock he looked like he'd been born black.

Last time I was back at the old plant, there was Snow Ball, still dirty, and still on the same job. He reminded me of what the Boss used to tell us when I was an apprentice—that the good mechanic proves it by keeping himself, his job, and his machine clean.

I've learned since that he was right. My cleanest men have been my best men, sure as shooting. Besides, in keeping the job and the machine clean, they often turn up the little troubles that grow to big ones before a monkey-wrench mechanic notices 'em. They don't bump projecting parts or drop files on working surfaces. They make machines last longer and work better. In addition to being good men, they're really unofficial inspectors, and they get the raises and better jobs.

Don't get me wrong. I don't go in for the shined-shoes, just-been-to-the-barber look about a man. I've heard Big Shots say that that's a good way to judge a man, but I'd rather watch him try a hammer and chisel once. If he can handle tools and keeps his own kit clean, he'll be o.k. with me. The Snow Balls who never use a bench brush or a wiping rag go down hill all right, but they don't get any bigger as they go.

The Big Shots feel the way I do about it, too—there's proof of it in almost any new machine tool. See the sleek lines, the rounded corners, the cutting out of dirt-catching pockets? That's streamlining for production, all right, because it invites the operator to keep the tool shined up and working just right. And from what they tell me, the operators have accepted the invitation.

Super Jim

ESTABLISHED 1877 **AMERICAN MACHINIST** BURNHAM FINNEY, Editor

Artillery Ammunition

In selecting equipment for shell manufacture, the question arises whether to use high-production machines of standard design or special single-operation machines that can be produced quickly in large numbers

By LT. COL. LEVIN H. CAMPBELL, JR.
Officer-in-Charge Artillery Ammunition Department, Frankford Arsenal

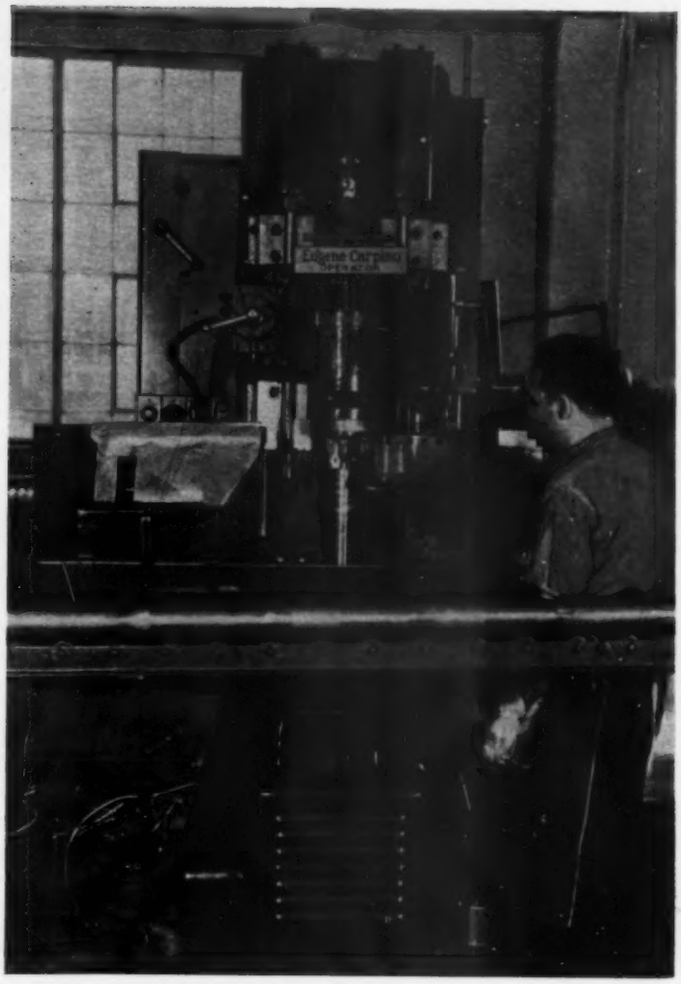

Fig. 1—This vertical lathe has proved itself in turning shells through use for over a year in Frankford Arsenal

FOR THE purposes of this discussion, I intend to confine myself to the particular phase of the problem relating to the production of metal components of artillery ammunition, and even more particularly, to the production of projectiles. The problem? WHAT TYPES AND DESIGNS OF MACHINE TOOLS MAY BE MOST EXPEDITIOUSLY PRODUCED IN TIME OF EMERGENCY, SO THAT SHELL MAY BE SUPPLIED TO OUR FIGHTING FORCES WITH THE LEAST POSSIBLE DELAY?

It is accepted in informed circles that the war load for munitions production must be carried, of necessity, by commercial industry. Our arsenals are not equipped for mass production. Their true function is to keep the art of munitions development and manufacture alive in time of peace. Their function in war is to continue such limited production and to assist in all possible ways in getting industry into large production in a very minimum of time.

Such assistance will take the form of sending experts to commercial plants having munitions contracts, giving advice as to the proper selection of machine tools, giving the designs of gages, fixtures and tools which the arsenals in time of peace have found to be best suited for the work. The production load must be carried by industry. Our traditional military policy since the very founding of this nation has been to provide most limited war reserve stocks of munitions. Upon the declaration of war, the country proceeds to convert industrial plants into munitions factories. Therefore, the production problem is one not only of mass production, but of even greater importance, is one of reaching mass production in the very least time.

Many of our friends who are engaged in mass production in industry, and who hold high place in large organizations, have expressed to us their amazement after an inspection of our artillery ammunition plant upon finding the required exactitude of manufacturing tolerances, and the number of operations necessary to produce an efficient artillery shell. They have failed to appreciate the enormous forces involved in the firing of a gun, and have failed to realize that an inaccurately machined shell cannot give accurate ranging. We feel and know that the Ordnance Department has done much within the recent past to improve design and correspondingly simplify manufacture of projectiles. With the aid of our great machine tool industry, we have done much toward introducing the latest types of suitable production machines and

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best methods of material handling.

Industry may, we believe, largely attribute its great advances in the production art, with consequent lessened prices of the finished article, to the development and use of special purpose machines. These machines of high production capacity have been designed and developed solely for the production of a particular part to the accuracy required. As such, we find relatively few machines in well-equipped production plants adapted to artillery ammunition production, especially shell production. Here at the Arsenal, however, insofar as possible, we have purchased our machines of standard designs with the special tooling required for the particular operations.

Fig. 1 is of a vertical shell turning lathe, which we use interchangeably for two types of 81-mm. mortar shell, for the 75-mm., and the 3-in. shell. In essence, the machine is little more than a horizontal lathe standing on end. It is, however, of special design. It has been in use for something over a year and is fully developed. The drawings are complete, and thus the machine may readily be placed in production.

We have thus far developed, we believe, the fact that industry, which is to carry the great mass production load in time of war, must first secure the major portion of the rapid, efficient and economical machine tools adapted to production of shell. By great mass production, I mean just that. Modern war demands shell, and more shell. Our forces at St. Mihiel, in that battle of more than twenty years ago, fired over a million rounds of artillery ammunition!

The question now is, what class of machines can be produced and placed in operation in a minimum of time? Whatever the decision is, we must have some regard, in my opinion, for the *number* of machines required of one type or another, the *output* per machine per day, and the *number* of operators required. We do not believe it trite to say that the output of our modern shell equipment per machine is tremendous as compared with the machines of the World War type. In a major war, manpower is always at a premium, and we must have due regard for its most effective use. There will be enough jobs, and more, for all.

The subject of machine tools for mass production of shell, under the conditions as outlined above, has been given a great deal of thought by those of us in the Ordnance Department. Many different possible solutions have been offered. One such consists in designing and developing simple, single-operation machines. This school of thought contemplates the design of a machine which will be so simple in its parts, that it may be produced in any number of good foundries and machine shops. It is held that these machines may be turned out in large quantities within 30 days after receipt of castings and material by a well-equipped shop.

Fig. 2 is of a belt-driven, single-operation special type of shell turning lathe. It happens to be one which has been specially designed and built for us within the past eighteen months. It exemplifies the simplest type of construction. The drawings are complete and are thoroughly developed.

Such a thought was followed by at least one major producer of shell during the World War. This concern designed and built its own single-operation machines and produced a large number of shell. It is quite true, also, that any such simple machine is not adapted to high-speed operation, and is hence barred from the use of modern production cutting tools. The machines in their very simplicity cannot be operated at high spindle speeds. We are speaking of simple machines which employ plain bearings throughout. In our experience we know of no work more "brutal" in its effect on a machine tool than the manufacture of a shell. Tool reactions are heavy and continuous hour after hour. The stresses set up are relentless in their effect upon all parts of the machine. There can be no "mercy" permitted in time of war. Production and more production is the cry!

We now come to another consideration which must affect production. How long will such simple machines retain the necessary inherent accuracy to produce shell within the required tolerances? What will be the down time for maintenance? What will be the rejection losses due to inaccurate machining? An inaccurately machined shell is an inaccurate shell in flight. Surely these factors must be given their proper position in the equation by which we are to determine a rational line of procedure for reaching mass production in a minimum of time.

Fig. 3 is of a single-operation machine used for rough facing the base of a 75-mm. or 3-in. shell. It is of a type used during the World War and is of simplified construction.

Others who have given a great deal of time and study to this problem have offered as a possible solution the use of multi-operation machines, which, as the name implies, perform simultaneously several operations. The modern shell production unit here at the Arsenal has been built around exactly this idea. Of course, "shell per man per day" is high, just as is the output of radios, for example, per man per day. We

Fig. 2—The simplicity of this shell turning lathe lends it to guide delivery in time of an emergency

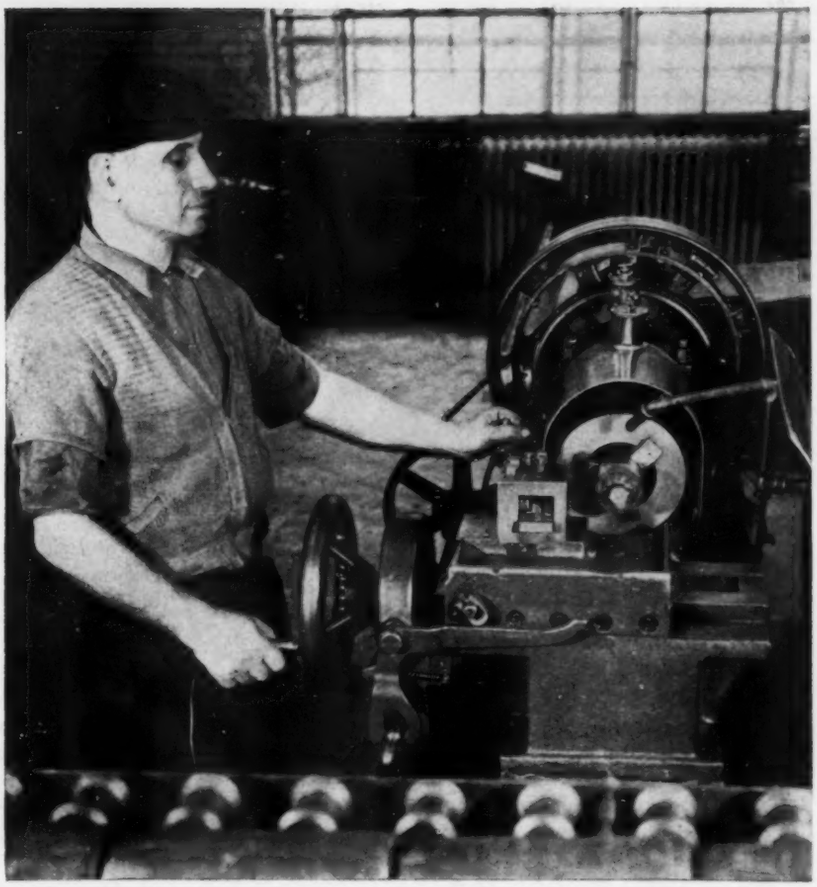


Fig. 3—Another single-operation machine, designed to face the base of 75-mm. shells, sacrifices high production to simplicity construction

are both using the best machines which industry has to offer for our particular purpose. The question is, however, can we get these machines in time of war as quickly as the single-operation machines mentioned above; that is, can we get the quantity of these multi-operation machines which will give the same number of shell per day as will the proportionately greater number of single operation machines required?

I am not a machine tool manufacturer, and as such, most certainly cannot speak for the industry. This question must be answered by the machine tool industry. In all humility, however, the observation is advanced that such may be done. A machine tool is, after all, nothing but an assembly of accurately machined and fitted parts, so designed as to produce a certain result. Frequently in the arsenals we have various parts made by commercial concerns and assemble them with parts which we have made to produce thoroughly satisfactory items of munitions. This is quite a common practice and we believe should be continued and enlarged. Tolerances of certain items of ammunition manufacture, from our observation, are most certainly the equal in exactitude with those found generally in the machine tool art. Therefore, the thought is presented that a machine tool for which the design is available, and from which the "bugs" have been removed, can be largely and successfully sub-contracted, as regards parts manufacture, with well-equipped machine shops. Such parts, of course, would be inspected at their place of manufacture, and would, after receipt at the parent plant, be assembled by experts.

We recently encountered the case of a certain machine shop engaged almost entirely in the manufacture of high accuracy parts for a certain aviation engine of highest quality. The inspection was indeed rigid and was under the eye of employees of the engine manufacturer. These parts were shipped some hundreds of miles for assembly into these engines. Surely, it would appear that if an engine of the power and type observed can be successfully made by such manufacturing procedure, a machine tool can, also.

Any piece of equipment, be it a machine tool or a wheelbarrow, requires just so many man-hours of labor to produce. In theory, if not actually in practice, if one man can produce a machine in one thousand days, one hundred men can produce the same tool in ten days. What we are trying to develop is, that to get a machine tool on the shell production line in the minimum length of time, we must put, not ten men to make the machine, but one hundred men, and therefore, decrease the time required to a tenth. We must employ not one plant, but many plants working simultaneously. No machine tool plant which the writer has visited has sufficient machine tool capacity to reduce its normal production time to a tenth. No machine tool plant so equipped could survive. Please be assured that no effort is being made to tell the machine tool manufacturer how to run his business.

The thought is presented, however, in the interest of ammunition mass production upon the declaration of war, that the use of a well designed machine tool for shell production will be made possible through the adoption of manufacturing methods as sketched above. The idea is, after all, but an extension of the present practice of the machine tool industry in going to specialists for their collets, bushings, chucks, etc. Should, however, such a method not be feasible and practicable, then it would appear that the single-operation machine is that which must be used to the exclusion of other types. The well equipped machine shops of the country will be employed in making these simple machines rather than in making parts for manufacturers of multi-operation machines.

I have approached various machine tool manufacturers and given assurance that any information they might give in this regard will be held as confidential. Such will be done as regards the disclosure of the sources of information. Let us see what some of these have to say in answer to the following extract from letters I have written to them:

> *"* * * The machine tool procurement in time of an emergency may be, as we see it, gone at in one of two ways, keeping in mind that the shortest possible time of supply may be the controlling factor.*
>
> *"First, we may procure simple, single-operation machines, such as may be made in any well-equipped machine shop. Their simplicity should result in their early supply.*
>
> *"Second, we may purchase standard, fully developed machine tools of design representing the current state of development, such machines to be furnished with as few of the extras and*

specially designed devices as possible —and the machine tool manufacturer to job out as many parts to various well-equipped machine shops as are available. Such parts would then be shipped into the plant of the manufacturer, who, with his skilled personnel, would assemble these parts, together with such as he had made, to produce the machine under order. In this way, it would appear that a large production of machines could be reached in a very minimum of time."

" * * Will you kindly also advise me as to whether, in your judgment, the second method is practicable for the manufacture of your equipment in time of an emergency?"*

Manufacturer *A* responds:

"The second suggestion is preferable for several reasons, such as, delivery, production capacity, cost of operation, type operators required, cost of tools, etc.

"Delivery—It is reasonable to assume that under emergency conditions the length of time required to manufacture simple, single-operation machines would be considerably longer than under normal conditions because many shops would require and purchase equipment of this type for their increased production.

"Delivery of standard developed machines, such as, rough and finish turning machines for the 3-in. and 75-mm. shell, could be made in a very reasonable length of time by doing as suggested in your letter, that is, that the supplier sub-let the manufacturing of parts to a maximum number of sub-contractors as are available.

*"Sub-letting as many of the parts as necessary would encounter no difficulty in our opinion, and regarding the assembly of the machine, that is just a matter of sufficient space and could be done anywhere under the right supervision. * * *"*

Manufacturer *B* responds:

"Your suggestion of getting very quick deliveries on machine tools by getting the machine tool plants to buy certain parts used in the building of their machines from other shops the writer believes is a very good idea."

Manufacturer *C* responds:

*"I have carefully considered the question you ask in your letter of the seventh and can see nothing that would prevent concerns having the proper equipment and personnel manufacturing many of the components going into our machines just as well as we could manufacture them ourselves. * * *"*

One manufacturer, who is making one of the most accurate and high class machine tools which has come to our attention, informs me that he is doing the largest business of his career without having increased his plant facilities or the number of his employees. He is having parts made by various well equipped machine shops and sent into his plant where they are assembled, together with such parts as he has of necessity to make, by his trained and skilled personnel. This is being done in time of peace—we believe it could be equally well done in time of war.

In our procurement planning, which, as is known, is being carried on in time of peace, we should definitely allocate certain machine shops to individual manufacturers of machine tools. Then, upon an emergency, the parent manufacturer will at once give his various sub-contracting machine shops the "go ahead."

We have prepared in tabular form, in parallel columns, a production set-up based on turning out 650 75-mm. M48 shell per eight-hour day from forgings of conventional type, with finished forged cavities which require no boring. The column to the left represents the modern equipment now in use in our shell plant, and the figures are based on actual production. The set-up shown in the right hand column is that composed of single operation machines and is based, in turn, upon actual production figures obtained in the shell shop as of eighteen months ago when this equipment was in use. The figures in both cases, in other words, are those actually reached and not estimated. We find that with the modern set-up, we require but a third the number of machines; we require less than half the number of operators; we require but half the floor space, and we have used the same number of pounds of steel and iron in producing the machines in each column, except that we find, in the case of the single-operation line, we must provide for the manufacture and installation of some 15,000 pounds of motors, shafting, pulleys, etc. Surely, manufacturers of modern machine tools should be able to produce thirteen machines under the proper conditions of manufacturing procedure in as short a time as can various machine shops produce thirty-five machines of single operation type. When the modern machine is installed, the maintenance cost for a long period will be practically negligible, and fourteen operators will be released for some other useful war effort.

Lt. Col. Campbell will continue his discussion of "Artillery Ammunition" manufacture in an early number.

SHELL, H. E., 75 Mm. M48

Note: Production Based on 650 Shell per Day. Eight hours per day. Forgings, Conventional Type, Finished, Forged Cavity.

MODERN PRODUCTION LINE BUILDING 55

Oper. No.	Operation	Type Machine	Machines	Operators*	Wgt.*
1	Face Open End	W. & S.	1.16	1.16	2,000
2	Center	Foster	0.65	0.65	1,400
3	Rough Face Base	Frew	1.4	0.7	2,500
4	Turn for Concentricity	Ex-Cell-O	1.63	1.63	15,000
5	Shot blast	Pangborn	0.6	0.6	5,000
6	Nose	Bliss Crank Press	0.5	0.5	12,000
7	Rough Face Open End	W. & S.	1.0	1.0	1,000
8	Finish Turn	Ex-Cell-O	1.0	1.0	7,500
9	Drill and Tap Lock Screw Hole	2-Spindle Drill Press	1.0	1.0	400
10	Finish Both Ends and Band Seat	Bullard	1.0	1.0	25,000
11	Notch	Producto-Matic	0.33	0.33	400
12	Stamp	Noble & Westbrook	0.33	0.33	400
13	Knurl	Symington	0.33	0.33	500
14	Apply Band	West Tire Setter	1.0	1.0	1,200
15	Turn Band	Sundstrand	0.75	0.75	1,500
16	Weld Base Cover	National	0.75	0.75	2,500
		TOTALS	13.43	12.73	78,300

* Weight includes motors and all equipment.

** Weight of machine exclusive of line and countershafting, motors, etc. Add weight of motors, shafting, etc., for production of 650 shell per on Symington Machines – – – 15,000 lbs.

Floor space required for Symington set-up (650 shell per day) exclusive of inspection, washing, painting and packing – – – 2600 sq. ft.

Floor space required for modern set-up (650 shell per day) exclusive of inspection, washing, painting and packing – – – 1376 sq. ft.

ARTILLERY DEPT. FIGURES FOR PRODUCTION ON SYMINGTON MACHINES

Oper. No.	Operating	Type Machine	Machines	Operators	Wgt.**
1	Cut Off Open End	Symington	3.0	1.5	3,000
2	Center Open End	100# Drop Hammer	0.13	0.13	7,000
3	Center Closed End	Symington	0.65	0.65	1,000
4	Rough Turn	Symington	5.38	2.69	6,000
5	Rough Face Base	Symington	2.25	1.13	3,000
6	Shot Blast	Gray	0.6	0.6	5,000
7	Nose	#69 Stoll Press	0.5	0.5	12,000
8	Chamfer Open End	Symington	0.33	0.33	1,000
9	Center Open End	100# Drop Hammer	0.13	0.13	7,000
10	Finish Turn (Base to Bourrelet)	Symington	3.0	1.5	3,000
11	Mark	Symington	0.33	0.33	2,000
12	Remove Center Boss	Symington	1.2	1.2	2,000
13	Weight	Scale	1.0	1.0	50
14	Finish Face Base	Symington	3.25	1.63	4,000
15	Bore, Face and Undercut Open End	Symington	3.25	3.25	4,000
16	Drill and Tap Lock Screw Hole	2-Spindle Drill Press	1.0	1.0	400
17	Tap Open End	Symington	1.3	1.3	2,000
18	Form Nose	Symington	2.0	2.0	2,000
19	Band Seat	Symington	1.62	1.62	2,000
20	Knurl	Symington	0.33	0.33	500
21	Grind Bourrelet	Symington	1.3	1.3	3,000
22	Press Band	West Tire Setter	1.0	1.0	1,200
23	Mill Notch	Symington	0.33	0.33	400
24	Turn Band	Symington	0.77	0.77	1,000
25	Weld Base Cover	National	0.75	0.75	2,500
		TOTALS	35.40	26.97	75,050

Wired for sound, the Caterpillar guide transforms a mass of machinery into an understandable story of manufacturing progress

Visitors Welcome

THE BEST way to convince the public that industry provides safe and comfortable working conditions for its employees is to conduct plant tours for visitors. "Seeing is believing."

Caterpillar Tractor Company has made it a point to take thousands of visitors through its factories ever since its organization in 1925. As most everyone knows, Caterpillar makes track-type diesel tractors, road machinery and engines. It sells exclusively through distributors whom it encourages to bring owners and prospective owners to Peoria for a two-day visit. It shares the expense of such trips.

A staff of experienced guides, an offshoot of the sales department, is available. Guides are selected on the basis of extended service in the factory, knowledge of the company and its products, alertness, friendliness and enthusiasm. They must have a pleasing appearance, a clear voice and excellent diction. After their selection, they are given a training course.

Studying the factors responsible for successful factory tours, the management came to these conclusions: (1) safety is paramount; (2) itineraries must be arranged with the visitor's convenience and comfort in mind; (3) trips must be classified to suit the interests of various types of visitors; (4) trips must mean something, visitors being given an orderly conception of what they have seen rather than confusing them with a mass of machinery and wheels; and (5) means must be devised for the guide to be able to explain the various manufacturing steps to everyone.

Visitors have come from everywhere—from universities, technical schools, luncheon clubs, government departments, churches, conventions, the professions and customer groups. The business of welcoming visitors to Caterpillar has become an important phase of public relations.

Requests from employees have brought into being a "family night" as an annual event. Employees are classified according to their departments and the shift on which they work and are assigned certain nights, usually during the late fall or winter, on which to visit the factory. A huge sales display room and motion picture theater adjoining it, seating 400, form an ideal set-up for this type of visit. Special programs are presented followed by factory tours.

The problem of guides making themselves heard by all members of a touring party in the factory above the noise of machinery has been solved by development by one of the guides of a portable amplifier powered by dry batteries. This instrument has been improved recently. It weights fifteen pounds, has a variable volume control, is strapped to the body so as to permit freedom of both hands, and is directional to prevent annoyance of factory workers.

Use of this amplifier has made one effective description of an operation sufficient for a complete group, whereas formerly only the visitors at his elbow heard what he had to say. The guide only has to speak in a normal tone to be heard.

During January, February and March of 1939 a total of 6,381 visitors from 38 states and six foreign countries inspected the Caterpillar plant. Of that number over 4,000 were employees, their families and friends. Caterpillar believes that close attention to plant visitors and encouragement of them pays dividends.

Crankshafts and Camshafts

In contrast to large automotive plants, the crankshaft jobbing plant must develop tooling and inspection equipment which is inexpensive, flexible and accurate

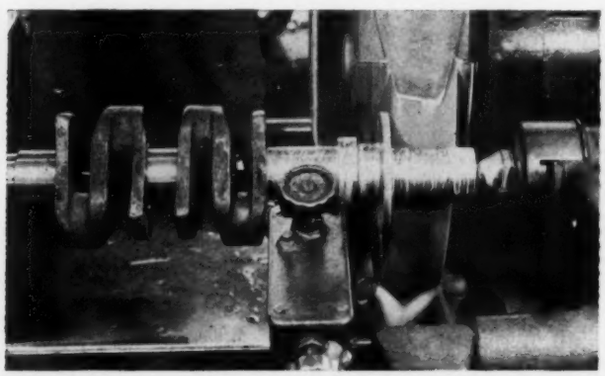
By T. E. CLARK
President, Atlas Manufacturing Company

ATLAS MANUFACTURING COMPANY is an independent jobbing concern producing over 90 different forged and cast crankshafts and camshafts for manufacturers of automobile, diesel and aircraft engines and refrigeration compressors. Material is generally supplied by the customer. Capacity of the plant is between 1,000 and 2,000 crankshafts per day, depending on size and design.

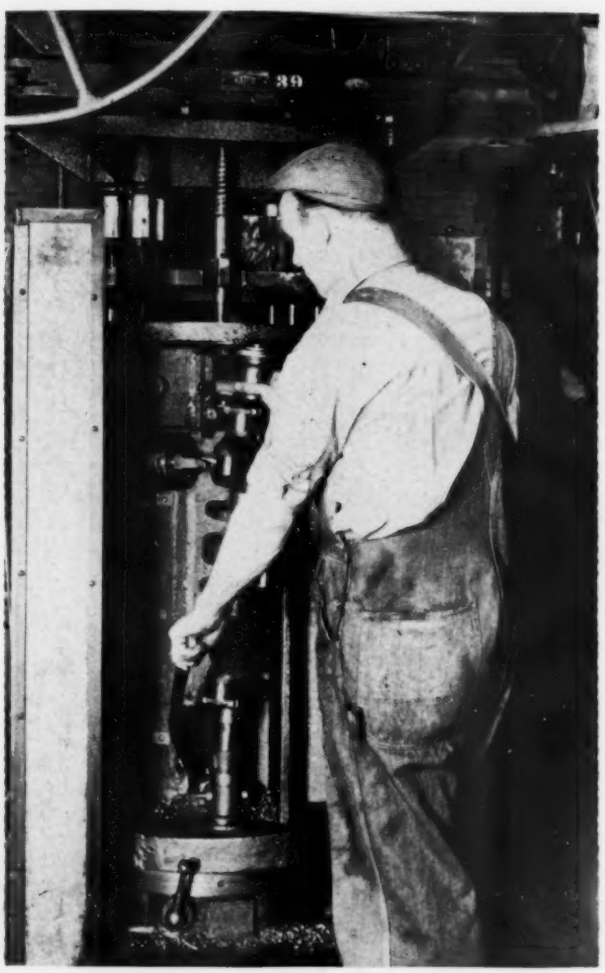
Because of the nature of the work, the plant makes a complete straight-line set-up for each particular job in order to keep down costs. This requires unusual flexibility in the constant rearrangement of equipment and tooling. Furthermore, the shop must maintain scrap loss at the exceptionally low figure of ½ per cent for two reasons: (1) to avoid the burden of excessive scrap losses and (2) to convince its customers of its trouble-free service.

In this shop the master mechanic follows the sequence of operations for crankshaft production and supervises the inspection. The difference between the various crankshafts is considerable and ranges from as few as five operations on a thrasher crankshaft to 103 operations for a large airplane-engine crankshaft.

Examples of experience accumulated by this shop in producing crankshafts and camshafts are shown.



Side Washers for Plunge Cut Wheels—High side walls on crankshafts give trouble in plunge-cut grindings because the sides of the wheel load and glaze. Moreover, the side walls are always thrust bearings and if burned by a glazed wheel they may develop cracks. The remedy is to supply filtered coolant through individual swivel-joint pipe lines to both sides as well as the face of wheel (a three-way nozzle is not suitable where various widths of bearings are encountered). Results of side-washer applications are: (1) production is increased 100 per cent per wheel dressing, (2) a finer grit may be used

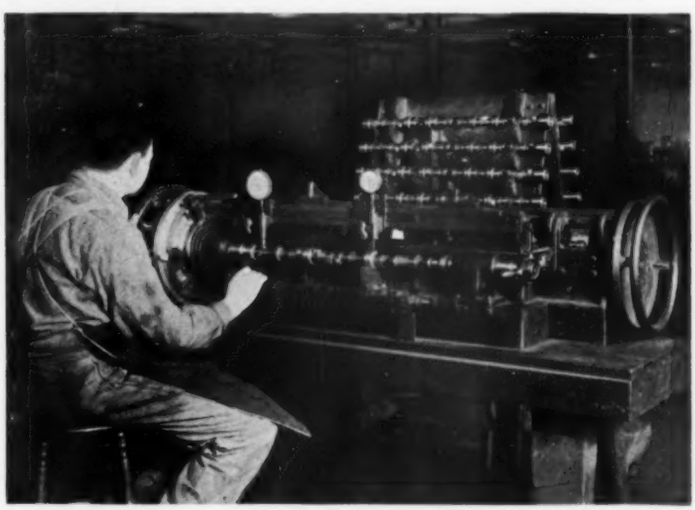


Drilling and Reaming Flange Bolt Holes—Many different crankshafts are produced on a jobbing basis, and fixtures must be interchangeable so far as possible. An example is the three-station fixture used on a Natco for drilling and reaming flange bolt holes. The front end of the crank rests in a female center operated by a pedal. The last pin bearing is placed in a side fork gage to align the bolt holes, and a cam-operated clamp lifts the flange pilot into a locating plate in the top wall of the fixture. The gage, the eccentric clamp and the locating plate are changed for different jobs

Pilot Hole Lapping—A rough pilot hole is often an undetected source of objectionable motor noise. For this reason the hole is lapped. Run-out is held to 0.00025 in. in contrast to usual blueprint specification of 0.001 in. This practice of checking and establishing closer working limits is one of the reasons why scrap losses are never more than ½ per cent. Pilot-hole operations are done on a turret lathe using fiber steadyrest jaws to support the main rear bearing. Sequence of operations is: (1) drill, (2) bore to true up the drilled hole, (3) undercut, (4) ream, (5) lap with 320-grain abrasive cloth on an expansion lap. Every fourth crankshaft pilot hole is checked by a floor inspector, and must be within minus nothing, plus a halfthousandth

Parallelism of Pins and Bearings—After the main bearings are cleaned up, the pin bearings are ground. When setting up Landis hydraulic pin grinders, the set-up men must have the inspection department check and approve all pin bearings for parallelism with the crankshaft main bearings. The crank is laid on V-blocks, and a special level graduated in thousandths is hung in turn on each pin bearing. Run-out of each bearing is checked at four positions 90 deg. apart around the circle. Standard allowance for run-out is 0.00025 in. for each inch of pin-boring width

Cam Inspection Fixture—During set-up of Landis cam grinders, the work is checked on this specially built inspection fixture, two of which are in use. Every tenth camshaft is checked to insure accuracy. The shafts are located by pins engaging locating holes in the end bearing. This establishes the correct angular relationship between the fixture and work when checking the contour of the valve cams and the fuel-pump eccentric. As the large graduated drum is turned, the contour of each cam can be checked by a dial gage reading in tenths to close limits



Cut-and-Carry Dies

Progressive notching, perforating, embossing, drawing, forming and cutting off are done in a single press tool by carrying the evolving part along in the strip

By C. W. HINMAN
Tool Engineer
Kobzy Tool & Electric Mfg. Company

THE PRINCIPLE of "cut-and-carry" dies is to perform all operations while passing the strip through several consecutive stations on the surface of the die block. The blank is notched to shape from either or both sides of the strip by heeled punches. A small neck retains the blank in the strip and serves to advance it from station to station.

The object in using this type of progressive die is to secure maximum economy of strip and high-speed, uninterrupted production. Simple parts, and some very complicated ones, can be completely fabricated in one pass. In spite of extra cost, cut-and-carry dies are profitable. With them it is possible to fabricate a piece in one press operation that could not be done satisfactorily by any other known method.

When the width of the blank and strip are equal, cut-and-carry dies are sometimes called "no scrap dies." In this case there is no skeleton of scrap passed out of the die. The scrap consists of small perforated slugs and notching waste. Sometimes, but not often, there is a narrow cutting-off waste. The work pieces are usually small springs, clips, brackets, terminals or connector lugs of light-gage materials.

The only drawback with these dies is the difficulty in using them for large work, or for materials exceeding about 0.0625 in. gage. Heavy materials require time to fabricate. If distorted, heavy blanks cannot be realigned, by using registering pilots, as easily as with thin flexible strips.

Sequence of operations for cut-and-carry dies is usually: Notch, perforate, emboss, draw, form and cut

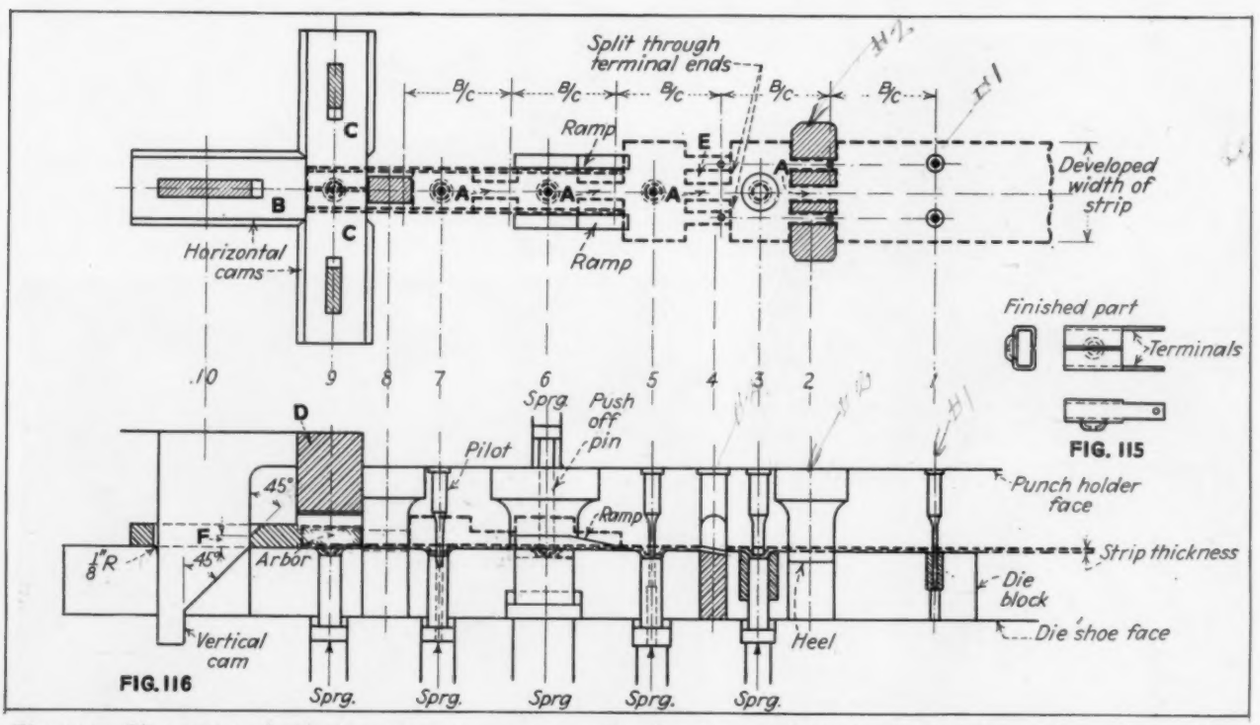


Fig. 115—First step in developing cut-and-carry progressive dies is to unfold the finished piece shown for a blank development. Fig. 116—The blank development leads to a work plan and a preliminary sketch of the tooling, as below

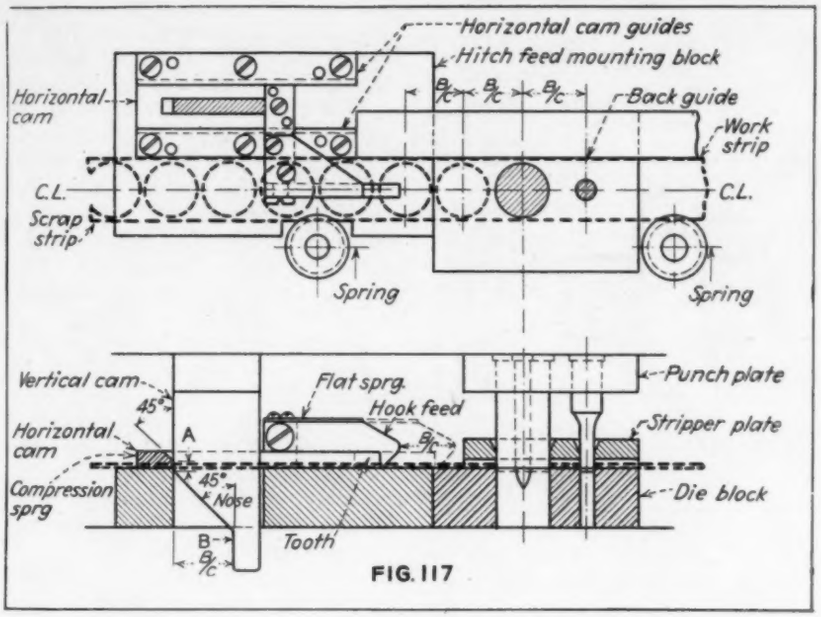


Fig. 117—A hitch feed attached to the left of the die is actuated by a vertical cam attached to the press ram, and no automatic stop is needed

off. Forming is done either before or just after cutting off. It is sometimes advantageous, however, to form one or more operations before severing the piece from the strip, while a final forming is done in the last station simultaneously with cutting off.

Before designing a suitable cut-and-carry die, the finished piece in Fig. 115 must be unfolded into a blank development. This procedure gives the developed width of strip, and shows the size, shapes and positions of all the necessary die operations. Next, lay out the work-plan view in red dotted lines and show consecutive die operations as in the upper view of Fig. 116. Also draw the cross-sectioned die openings. Project the front elevation below the plan in a shut position. Draw the views schematically. Show all necessary punches, die openings and spring shedders that correspond with the several stations in the plan. A preliminary sketch of the future die is now well in hand. This is the tentative stage of the tool, or a *discussion sketch.*

Naturally, the die operations are arranged in logical order: perforate; notch and emboss; split sever terminals and pierce embossure; form U between ramps; pilot; cut out connecting neck and form over the sides with horizontal cams and "spank" to size. An exact sequence is: (1) perforate, (2) notch, (3) emboss, eject strip with die shedder, (4) split sever terminals, (5) pierce embossure and eject strip with die shedder, (6) form U between ramps and eject strip with die shedder, and with a push-off pin in punch, (7) pilot, (8) cut out connecting neck *A*, (9) advance horizontal arbor cam *B*, form over sides with the opposite horizontal cams *C-C*, and spank work to size with punch *D*. The side cams *B* and *C-C*, are loosely fitted to allow movement for spanking. The work is advanced through the stations by means of the connecting neck *A*.

The next step is to determine the position of several necessary finger stops, and the type and position of the automatic stop. These subjects have been discussed. Not shown is the necessary channel stripper plate, but it should terminate between stations 5 and 6. The die block is abnormally long, and its sectional points of divisions must be determined. The piece is usually blown off with air, if possible, but sometimes this cannot be done because the cams interfere.

A suggestion for work delivery is to strip the piece from cam *B*, as it recedes, and to provide a clearance hole through the die into which the work will fall.

Positions of the angles on the vertical cams that operate *B* and *C-C*, must be "timed" to advance arbor *B* ahead of *C-C*. Note that the vertical cams, at maximum descent, lock the horizontal cams by means of the dwell space *F*. When the ram ascends, the horizontal cams are caused to recede to a normal stop by attached springs, not shown.

Several problems must be solved for this tool. For example, in splitting through the terminal ends, the work may not register the same at each advance, and a small notch or protrusion may appear on the blank after splitting. The remedy, if one be necessary, is to allow sufficient stock at this point to shear off a width slightly greater than the stock thickness. The amount sheared off must obviously be added between the blanking centers. This alteration would increase the cost of both the work material and the tool. However, a rectangular pilot punch can be made to enter slot *E*, before splitting, and would take care of the difficulty, at a slight increase in expense.

Another consideration is grinding. The part of the die block that carries cutting edges must either be "shimmed up" after grinding, to maintain its level with the forming blocks, or the forming blocks must be ground undersize to keep the block surfaces in the same plane. This indicates that there must be a

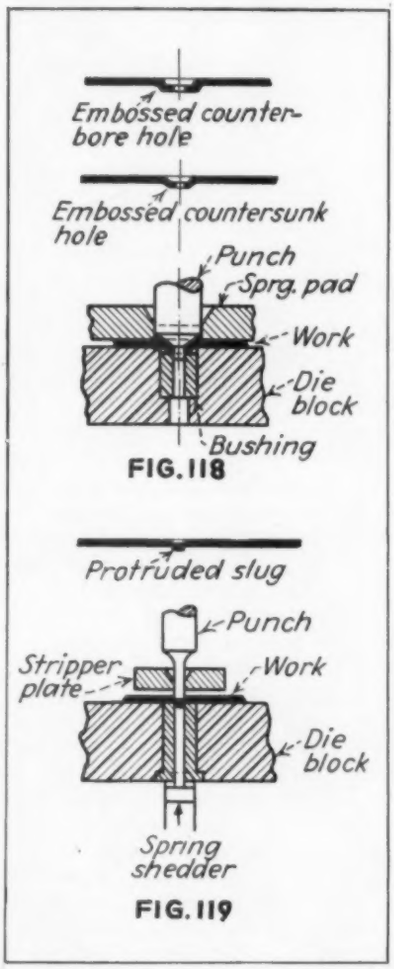


Fig. 118—By this construction the countersink is practically embossed before the hole is pierced, thereby avoiding enlargement of the hole. Fig. 119—Protruded slugs on the face of a part are of value in locating it with reference to another part

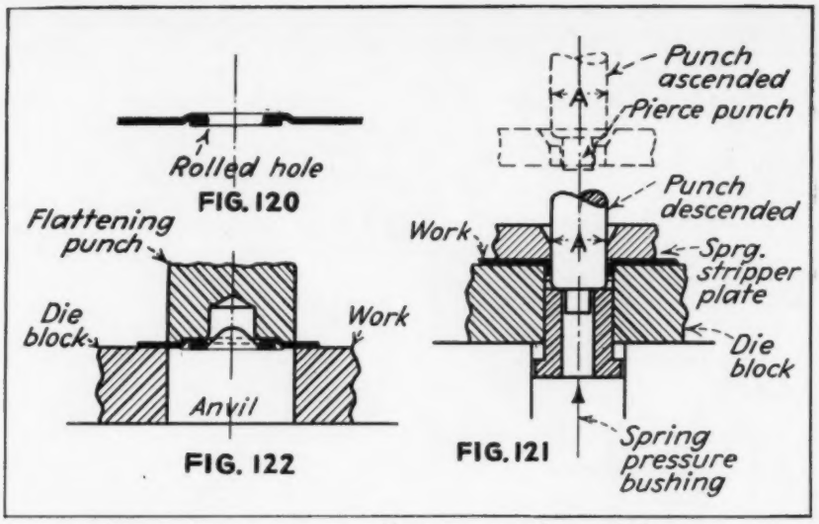


Fig. 120—Insulation on wire or cable is prevented from being cut or worn when pulled through holes in apparatus, if a rolled and seamed hole is employed. Fig. 121—A "rolled" hole is started by piercing and extruding with a single punch. Fig. 122—With the extrusion placed down on the anvil, it is rolled under and seamed

division between the cutting and forming blocks. Another suggestion is: It may not be necessary to use spring shedders to raise the strip from the forming blocks; a trough cut along the horizontal center line of the blocks will clear the embossing on the work. These questions show the value of making a "discussion sketch." They reveal the necessity for carefully analyzing each operation.

In blanking dies where a skeleton of scrap passes out, a hitch feed can be made a functional part of the tool. Automatic stops are then unnecessary. The principle is presented in Fig. 117, and the operation is shown at the bottom of the press stroke. A simple operating mechanism consists of a horizontal cam working between guides. This cam is positioned parallel with the work strip at the left of the die, and just above the strip.

A "hook feed" is attached by a fulcrum screw to a block secured at right angles across the horizontal cam. A flat spring forces down the tooth on the hook so that it slides on a plane coincident with the die block surface. The hooked tooth engages over the "bridge" in one of the blanked holes of the scrap. When the ram descends, the vertical cam enters a slot in the horizontal cam. A 45-deg. nose on the vertical cam pulls the hook and strip toward the left equal to a distance of one blanking center, or *B/C*. This movement exposes an uncut portion of the work strip to be pierced and blanked. Meanwhile, the vertical cam locks the hook in place, by entering a dwell space *A*, which occurs just before blanking.

When the vertical cam ascends and the work material is stripped, a compression spring causes the horizontal cam to advance toward the right until the tooth engages the next scrap bridge. This occurs when the left edge of the slot in the horizontal cam begins to ride on the dwell space *B* of the vertical cam. While the rise on the vertical cam nose is 45 deg., in this case it is obvious that its run should always be equal to the *B/C*.

A brake to prevent over feeding consists of two spring rollers. These ride against the front edge of the work strip.

Piercing and embossing a countersunk hole can be done in several ways. The hole can be pierced at one station. An embossing punch, with a pilot that engages the pierced hole, is brought into action to emboss and "spank" the countersink at a subsequent station. However, this method usually distorts and enlarges the hole, because the hole is *pierced before* embossing the countersink.

Another method, given in Fig. 118, is done at one station. The pierced hole is not enlarged, because it is *pierced after* the countersink has been practically embossed. In operation, a strong spring pad holds the strip, while the punch descends and embosses the countersunk portion of the strip down to the bushing face, where the hole is pierced. The punch, continuing in descent, spanks the countersunk portion of the metal around the hole.

An embossed counterbore can be pierced and embossed as shown in Fig. 118, but the metal is likely to be drawn away from the hole, because the hole is *pierced before* the counterbore has been fully embossed. If an enlarged hole is objectionable, it is best to emboss the counterbore in a previous station that has an ejecting shedder. In another station, pierce the hole on a bushing face below the die surface, as shown in Fig. 118. The bushing can be designed as a shedder to eject the work after piercing.

In sheet metal thicknesses exceeding $\frac{3}{64}$ in., a pierced slug can be punched part way out, usually to a height of half the stock thickness. These protrusions serve as dowels for locating another piece in apparatus assembly, or for locating the piece itself on another part. Two slugs are protruded for a double location of the part, and their diameters and center distances must fit the holes into which they are assembled.

The die operation for protruding a slug is shown in Fig. 119. The protruded height is governed by the depth of press stroke; the stroke of the press being shown *down* in the figure. It dies where the position of punch faces is important at the down stroke, it is best to arrange bumper stop blocks between the punch holder and die shoe. These blocks are an aid to the die setter, and also limit overthrow in the press stroke.

When the ram in Fig. 119 ascends, the spring shedder follows up the punch and ejects the work from the die. Meanwhile, the positive plate shown above the work, strips it from the punch. Diameter of the protrusions will be between 0.001 and 0.002 in. larger than the die openings. This increase should be considered for precision work.

The rolling and seaming of pierced holes, usually called a "rolled hole," is shown in Fig. 120. It is a smooth hole with nicely rounded edges inside. It is mostly used as an opening for conducting small cables.

Rolled holes of $\frac{1}{4}$ in. diameter and up are done at two die stations, Figs. 121 and 122. For rolled holes under $\frac{1}{4}$ in. diameter, three operations are generally required. The hole is pierced in the first station, and the second and third operations are similar to those in Figs. 118 and 122.

In Fig. 121, the hole is cut by the pierce punch in descent, when it enters the spring-mounted die bushing. Continuing in descent, the body diameter *A* of the punch extrudes the pierced hole as shown. In the second operation, the extrusion is rolled under and seamed against an anvil when the flattening punch descends.

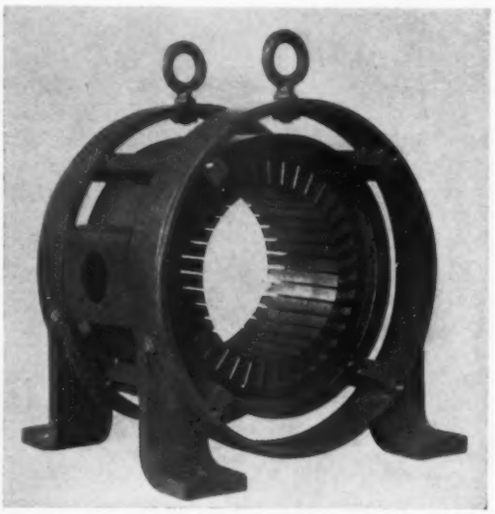
Universal Fixture Aids Welder

Two axes of rotation permit the positioning of parts so that all welds can be made down-hand

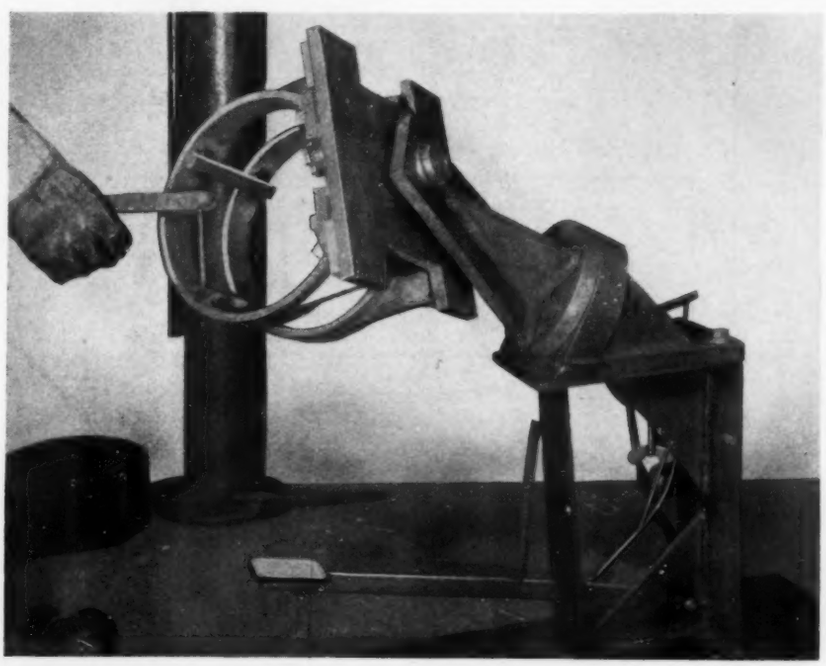
By J. H. YEAGER
Tool Design Department
Reliance Electric & Engineering Company

WHEN WELDING feet and braces to stator bands in the manufacture of welded frame a.c. induction motors, it is of convenience to the welder if he can turn his work so that it always will bear the same relation to his hand and welding rod without his having to assume uncomfortable working positions. Also, weld quality can be controlled more accurately when all welds are made in the down-hand position. Since feet and braces on welded motor frames present a multiplicity of angles in welding, the fixture shown was designed and built to make it possible for the operator to move the work to suit the weld being made.

To accomplish this, the fixture was arranged with two axes of rotation. The first axis derives its motion from a short shaft directly under the work, so as to allow the work to rotate about its own vertical axis. This first axis is held by an arm which, in itself, is capable of rotation about the second axis at the opposite end of the arm. The foot pedal incorporated in the base of this fixture serves to release a plug clutch in a faceplate around the second axis of rotation to the right of the fixture. Several positions can be obtained easily by providing properly spaced holes in the faceplate. A variation of this design would be to incorporate a friction clutch in place of the plug clutch, so that the faceplate can be turned to any desired angle. This fixture not only has reduced operator fatigue, and so increased his efficiency, but it has also made possible higher production because of the ease with which the work can be properly positioned for all welding operations.



Design of this induction motor frame is such that welding operations must be performed at many angles when attaching the feet and braces



The foot pedal on this fixture serves to release a clutch on the face-plate attached to the supporting shaft. Either a plug clutch, as shown, or a friction clutch can be used

Short Cut for Shop Orders

Time is saved in starting work by means of a system which selects standard instructions from a master card

ONCE AN industrial plant has grown beyond a certain size, a method of keeping track of parts and materials can no longer be carried around under one man's hat. Some kind of a system is necessary. The ideal is a system that will do the job thoroughly without becoming more important than the productive operations of the shop.

Until one delves into the subject, he does not realize how many different things a shop system is required to do. It may be called upon to perform any or all of the following functions:

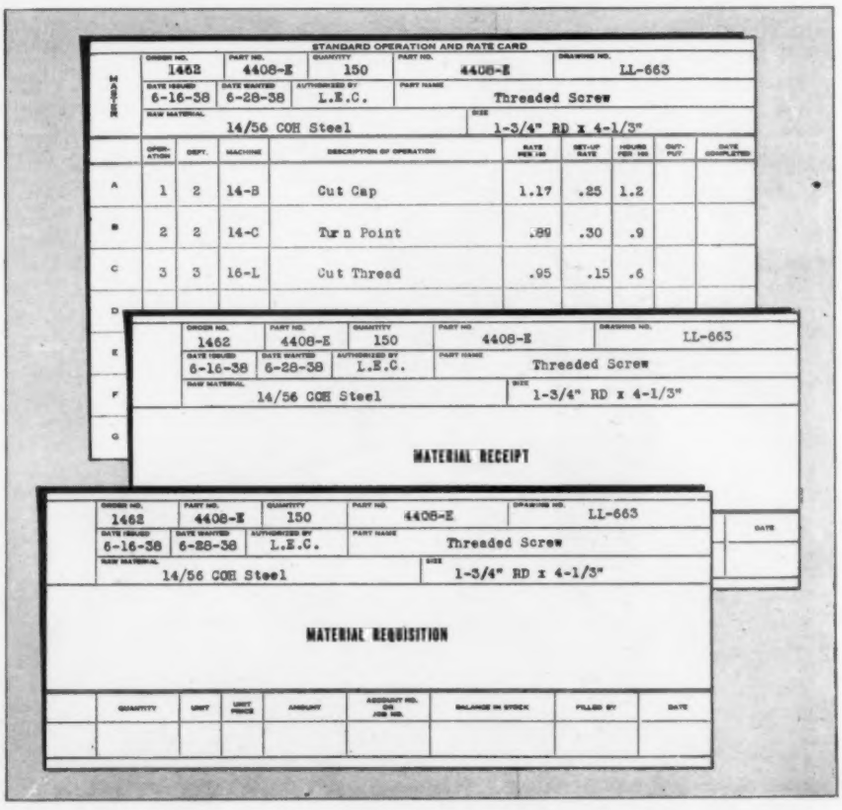
1. Notify the stockroom that certain materials will be needed on a certain order.
2. Set up a system of receipts for the withdrawal of material from stock.
3. Supply route tags to identify the material as it travels through the shop.
4. Control the movement of the job from operation to operation.
5. Notify the various shop departments of the parts required to fill a certain order.
6. Determine machine load for posting on the schedule board.
7. Carry to the shop the standard time allowed on each operation of each piece.
8. Advise the assembly department of the parts required to complete a given order.

When standard parts are routed through the shop it will be readily seen that a considerable number of forms must be made out if the above requirements are to be met. Some of the information on these forms, such as the order number, the part number, the quantity and the name of the part will be repeated on all of the forms. Part of the forms will contain complete information as to the sequence of operations and the time allowance on each one. Others will contain only a portion of this information, usually only that part which affects the particular operation to be performed with the other data deleted.

In order to prevent the paper work from becoming burdensome, mechanical duplicating systems have been applied to the making out of shop orders with considerable success. One such system, developed by Ditto, Inc., has the advantage of duplicating shop forms for a part order and also of setting up a master which can be used on subsequent orders for the same part. The use of this master saves duplication of work and also the possibility of error on repeat orders. It is now being used by such concerns as the Chain Belt Company, the Harnischfeger Corporation and the Oliver Farm Implement Company.

The system operates as follows: A master order is made out for each part which contains all the standard information such as the part number, the part name, the drawing number, the kind of material, the routing, description of operation and the standard time for each operation. This card is typed with a special aniline ink which enables it to be reproduced by the Ditto direct-process machine. For each order there is a variable master strip similarly typed, which can be placed above the master card to add such information as the order number, the quantity, the date of issue, the date wanted and the initials of the person authorizing the order.

When the order comes in from a customer, the material lists for each sub-assembly are obtained from the



STANDARD OPERATION AND RATE CARD

ORDER NO.	PART NO.	QUANTITY	PART NO.	DRAWING NO.
1462	4408-E	150	4408-E	LL-663

DATE ISSUED	DATE WANTED	AUTHORIZED BY	PART NAME
6-16-38	6-28-38	L.E.C.	Threaded Screw

RAW MATERIAL: 14/56 COH Steel — SIZE: 1-3/4" RD x 4-1/3"

	OPERATION	DEPT.	MACHINE	DESCRIPTION OF OPERATION	RATE PER 100	SET-UP RATE	HOURS PER 100	OUTPUT	DATE COMPLETED
A	1	2	14-B	Cut Cap	1.17	.25	1.2		
B	2	2	14-C	Turn Point	.89	.30	.9		
C	3	3	16-L	Cut Thread	.95	.15	.6		
D									
E									
F									
G									

MATERIAL RECEIPT

ORDER NO.	PART NO.	QUANTITY	PART NO.	DRAWING NO.
1462	4408-E	150	4408-E	LL-663

DATE ISSUED	DATE WANTED	AUTHORIZED BY	PART NAME
6-16-38	6-28-38	L.E.C.	Threaded Screw

RAW MATERIAL: 14/56 COH Steel — SIZE: 1-3/4" RD x 4-1/3"

MATERIAL REQUISITION

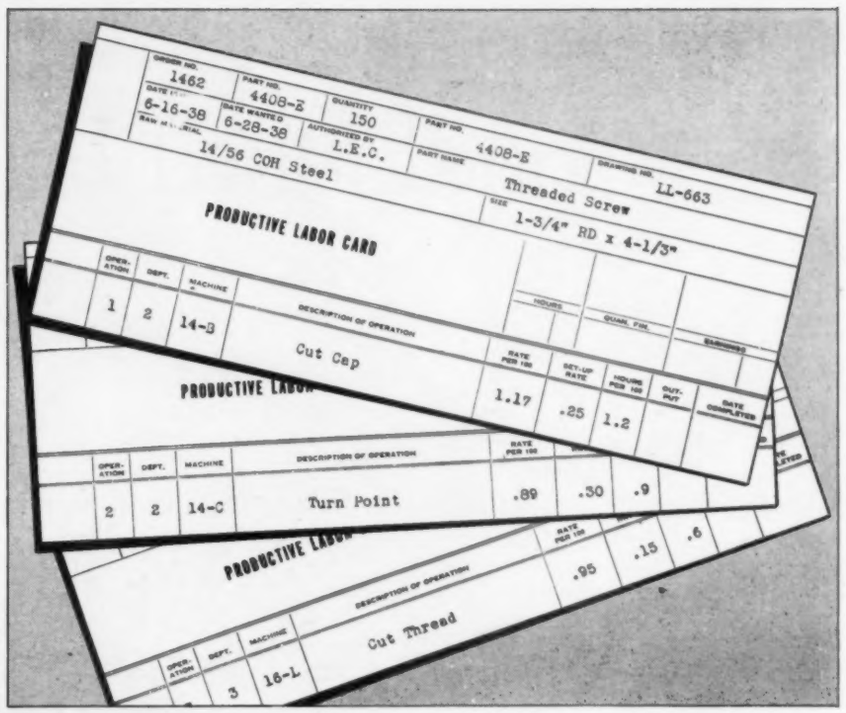
	QUANTITY	UNIT	UNIT PRICE	AMOUNT	ACCOUNT NO. OR JOB NO.	BALANCE IN STOCK	FILLED BY	DATE

engineering department, and the corresponding parts order cards are taken from the file. To this order master the variable strip as described above is added for each part. An advantage of the system is that selected portions of the information on a master card can be transferred to the various forms.

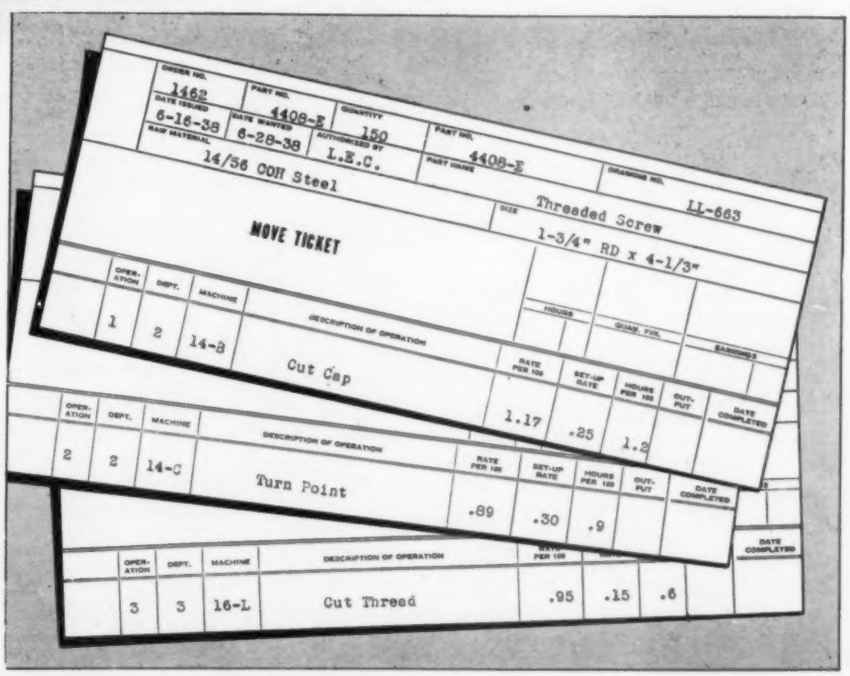
For instance, on the material requisition and the material receipt, it is not necessary to give the complete routing or the time allowance on each operation. All that is required is the general specifications of each piece which, of course, includes the number required, the material to be used, and the size of the material if it is to be cut from bar stock.

Productive labor cards, which are often hung on the machine when the part is in process, should contain the description of the operation and the time allowance. In many cases, however, it is desirable not to include the same information for other operations on the same part. The Ditto machine makes it possible to transfer the selected information desired by means of a series of snap guides which locate the cards correctly to receive only the information desired. On the other hand, the main parts order card which is used for scheduling the work through the shop should have a complete notation of the entire routing with the standard time for each operation.

It can be seen that, since the master cards are already in file when an order comes in, it is possible to save from 24 to 36 hours in getting the work orders to the shop.



Machine parts can be controlled through a series of shop forms which requisition the material, route the work through successive steps in manufacture and provide records for the office. By means of the Ditto machine each card is printed with only the information needed for its particular function

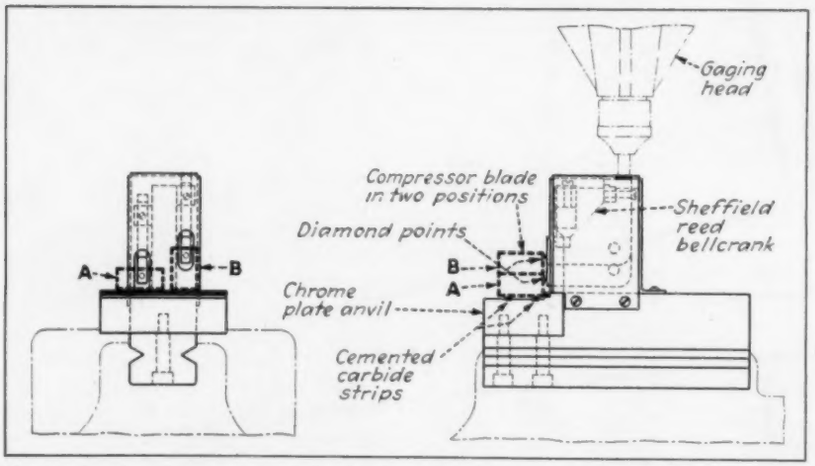


Conditioned Precision

II—Close fits are maintained in the Norge refrigerator compressor by means of an inspection system that sorts parts to half a ten thousandth of an inch

By C. D. DONAVEN
Vice-President and General Manager
Norge Division, Borg-Warner Corporation

Each of 81 die-cast boxes in the classification rack receives a particular combination of blade width and height checked to half tenths



Two tests for squareness of the blade are made to 0.0001 in. on one visual gage: at A, *squareness of an edge is checked with a face; as at* B, *squareness of one edge is checked with an adjacent edge*

COMPONENTS of the new Norge hermetically sealed refrigerator compressor unit are commonly finish machined to total tolerances of 0.00015 or 0.0002 in. These close limits are further split into half tenths during inspection for selective assembly. Process specification charts at each inspection station assist the operator in distributing the part into five or more classifications of size. One part, the blade, is sorted into 81 classifications.

Inspection under such a system demands an accurate and rapid method of gaging for attainment of economy. Twenty-three Sheffield visual gages and a number of dial indicators are used in the finish machining department, so that operators can check their set-ups according to the tolerance specifications posted on process specification sheets. A like number of these visual gages is used in inspection to check the parts and to classify them for assembly. Special work-rests and gaging attachments are applied to the visual gages in order to check one or more dimensions of the part.

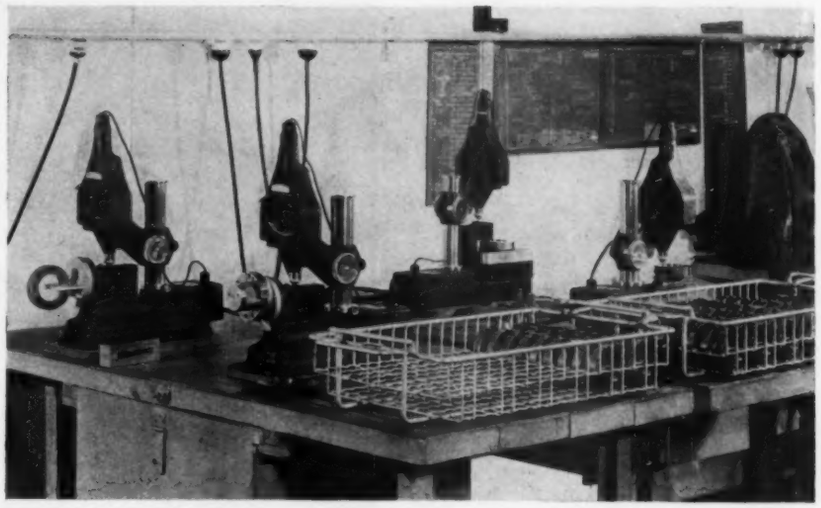
Two visual gages are used by the operator inspecting the blade. With one he checks squareness to a tenth. Parts that pass are next checked for thickness to a half tenth on a dial indicator. Then using a second visual gage he checks the blade width to half a ten-thousandth, and grades the parts into a wire basket accommodating nine rows. Each row is set aside for a given half-tenth width classification. After all blades are checked for width, the operator resets the gaging head for the height of the blade. As the blades taken from the basket are checked for height, the inspector puts them into die-cast boxes in the classification rack in front of him. Each box represents one of 81 clas-

sifications of blade for width and height. When the die-cast boxes are filled, they are transferred to a central storage rack, whence they are taken for use in assembly.

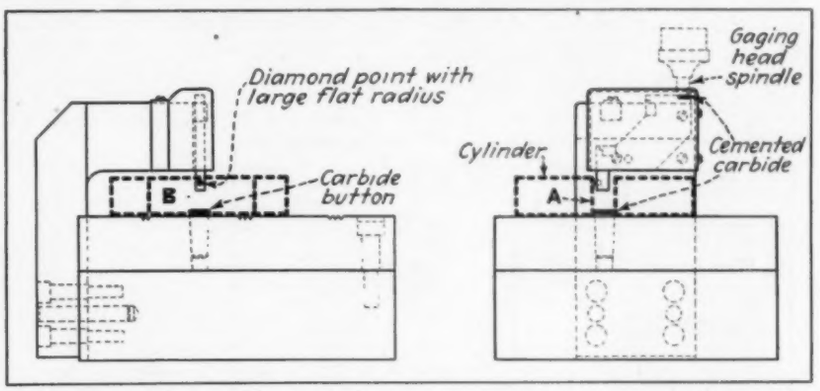
Final inspection of the cylinder involves the use of four visual gages, of which three are fitted with special gaging means. Width of the cylinder is maintained in finish machining to a total tolerance of 0.0002 in., and this is graded into five classifications by half-tenths, using a conventional gaging set-up. The width is rubber stamped with the classification number and placed in the proper basket. Assembly operators are assisted by rubber stamping the exact dimension on the part. If a cylinder slot is marked H + 2, for example, selection of a blade marked H + 2 automatically gives the right clearance.

For the second inspection—squareness of the blade slot and bore with respect to the faces—a special gaging attachment is applied to the second visual gage. The fixture has a serrated lapped plate incorporating a fixed cemented-carbide measuring button. The button is about $\frac{1}{16}$ in. high and enters the slot freely. A movable measuring point engages the slot near the top and is equipped with a diamond for wear resistance. With both points against one side of the slot, the reading on the gaging head scale is read. Then the part is moved so that the other side of the slot contacts the measuring points, in order to check its squareness with the face of the cylinder. Finally, the squareness of the cylinder bore with the face is noted by moving the bore around the fixed button.

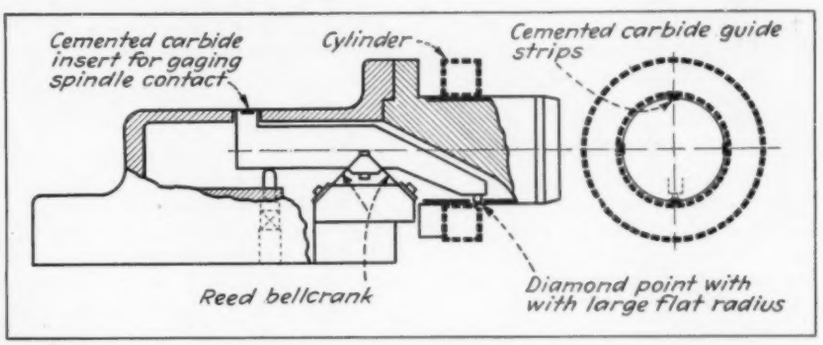
In the third inspection, the cylinder is slipped on the gaging mandrel of a third visual gage, in order to check the diameter of the bore. Total tolerance is 0.0008 in., and the part is graded by half tenths into seventeen classifications. To check the bore the ring-like cylinder is slipped over the mandrel, which is fitted with four fixed cemented-carbide lands and with a movable diamond point connected by a patented Sheffield reed

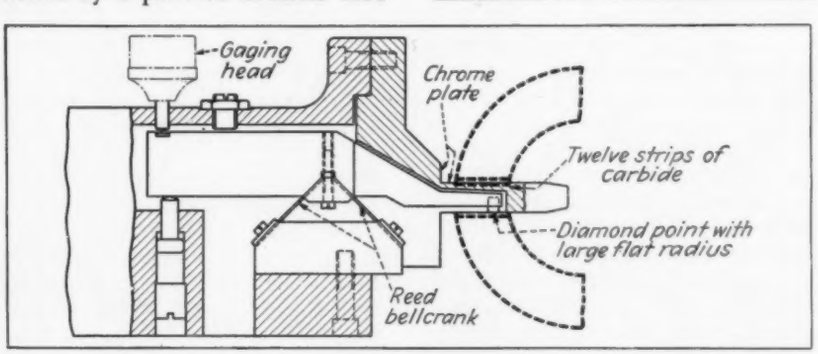


Four Sheffield visual gages are required to inspect the cylinder. From right to left they are used: for width or thickness; squareness of slot and bore with respect to face; diameter and roundness of bore; and width of slot



A fixed cemented-carbide-tipped button in the lapped serrated plate and a movable diamond-tipped measuring point, connected through a reed and bellcrank system to the gage spindle, touch the slot as at A or the bore as at B to check the squareness with respect to the face


Cemented carbide insert for gaging spindle contact
Cylinder
Cemented carbide guide strips
Reed bellcrank
Diamond point with with large flat radius



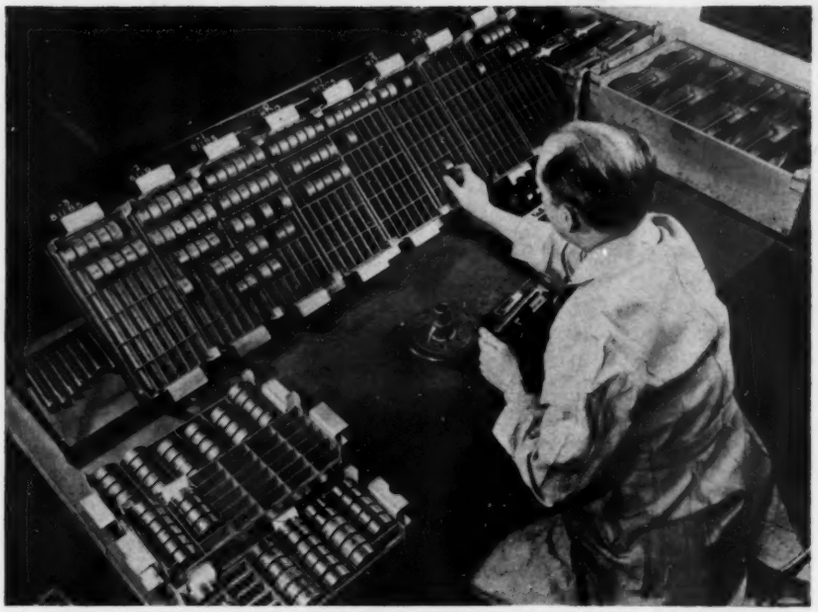
Four cemented-carbide guides center the cylinder bore and constitute the fixed measuring points, and a diamond-tipped movable point measures hole size and roundness

Width of the cylinder slot is inspected by resting one side on the serrated, cemented-carbide strips on the top of the tongue of a special visual gage attachment, while the movable diamond point rides on the other side of the slot

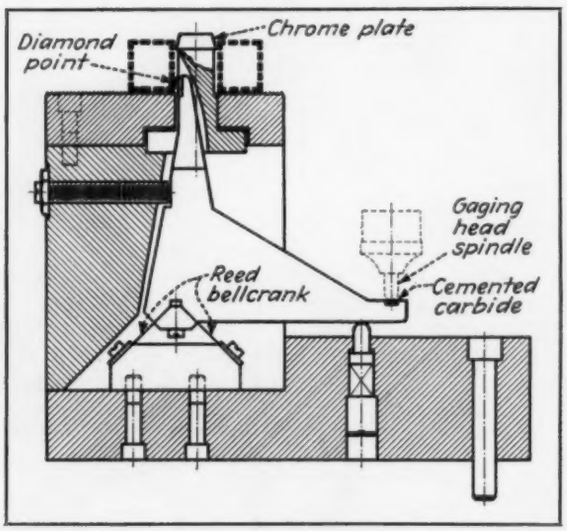
and bellcrank system to the measuring spindle of the visual gage. The same reed and bellcrank system is used in the other instruments employed for checking in finish machining and inspection.

As the fourth operation, the width of the slot is graded into nine classifications on another visual gage with a special attachment much like the previous one. In this case, however, the gaging part of the attachment is a long tongue that enters the slot. The top face of the tongue is fitted with twelve cemented-carbide serrations, which constitute the fixed measuring point, or surface. The movable measuring point is located in the bottom face of the tongue and operates the measuring spindle through a bell-crank and reed system.

Using a single visual gage, two inspections are carried out on the roller. The gaging attachment consists of a lapped, serrated plate from which protrudes a stub mandrel incorporating a diamond measuring point. With the roller resting on the serrated plate, the part is pushed against the mandrel to check the squareness of the outside diameter with respect to the face. With the bore placed over the mandrel, the squareness of the hole with respect to the face is checked. Both operations must come within 0.0001 in.



A classification rack grades rollers into eight thicknesses by half tenths to assist in the selection of a roller to match a given cylinder; the roller is then placed in a small die-cast box with an eccentric shaft for finish grinding both parts



After the previous inspection, the roller is placed over the mandrel containing the movable measuring point, and the squareness of the hole with respect to the face is determined

Roller thickness is checked on another visual gage, and the part is distributed into eight classifications by half tenths. Each classification is put in a die-cast box holding 30 pieces. When the box is transferred to subassembly, the operator matches the width classification number on the roller with the width classification number on the cylinder already assembled to the end-bearing plate. In this way cylinder and roller are matched for thickness.

After the proper roller is selected the operator places it in a small die-cast box which is numbered to correspond with the number on a large container. The large box is fitted to carry ten sub-assembled end-plates and cylinders along with ten die-cast boxes with matching rollers and their rough-ground shafts. The large box is transferred to a point adjacent to a roller conveyor that takes the die-cast boxes containing rollers and shafts into the finish machining department. As explained previously (*AM*—Vol. 83, page 297) the shaft eccentric is ground to suit the hole size stamped on the roller and the roller is ground to suit the rise on the eccentric of the shaft. After these operations and final inspection of the roller-shaft assembly, the die-cast box containing the two parts is returned to the larger container. Then the ten sub-assemblies of end-bearing plate and cylinder with matching sets of roller and shaft move into final assembly.

Final inspection of the roller and shaft is done right in the finish machining department. Three Sheffield visual gages are used for three checks. The first one checks the diameter of the straight part of the eccentric shaft and the taper. The diameter of the shaft is graded into five classifications by half tenths in a total tolerance range of 0.0002 in. Allowable taper is 0.0001 in. The second visual gage checks the squareness of the eccentric end of the shaft in relation to the shaft axis within a total tolerance of 0.0002 in. An adjacent dial indicator checks the rise of the eccentric by half tenths. A third visual gage checks the run-out of the roller with respect to the eccentric, and this must not exceed three-quarters of a tenthousandth. The shaft is placed in the comparator fixture and the fiber jaws are clamped on the shaft to hold it tightly in the V-blocks. Then the roller is slipped on the eccentric and rotated under the gaging point of the visual gage.

Roller and shaft assemblies that pass all three inspections are returned to the die-cast boxes for transfer to the final assembly.

Cold Forming Operations On Stainless Steels

II—Press-work was described in the author's previous article. He now discusses spinning and draw rolling

By WALTER M. MITCHELL
Metallurgical Engineer

BECAUSE of the greater strength of stainless steels greater power is required for spinning than is used for mild steel. Stainless steels cannot be spun in one operation to the depth obtainable with softer metals, and more frequent annealing will be required before the final form is attained. It is desirable that spinning operations be carried out, so far as is possible, in such manner that the metal is subjected to tensile stresses only, as spinning under compressive stresses is a much more difficult operation.

The best type of spinning tool is of hardened alloy steel or alloy cast iron [see the previous article (*AM*—Vol. 83, page 291) for a suitable composition and treatment] of nearly the same design as used in spinning copper, but somewhat flatter so as to have greater bearing surface. This applies whether either the spinning bar, or spinning roll, is used.

A Limit to Spinning

For straight chromium (martensitic and ferritic) steels reduce speed to about two-thirds that customary for mild steel. Ordinarily these steels can be spun to about one-third the extent of mild steel before requiring annealing.

Austenitic stainless steels, as 18-8, require reduction of speed to about half to a fourth that used for copper or soft metals. It will not be possible to spin to nearly the depth possible with softer metals, and the operator must use good judgment in determining how far spinning may be carried before annealing is necessary. If carried too far stresses will be set up which will crack or split the piece spontaneously. On account of the greater stiffness of these steels and their different flowing qualities, it may be found impossible to reproduce in stainless steel, with the same tools, a shape previously spun in softer metal. In such cases the contour of the spinning form must be altered accordingly.

It is advisable in all spinning operations on stainless steels, where the desired shape of the part permits, to leave one or two inches of rim unworked until operations are nearly finished. This will tend to prevent cracking or splitting at the rim itself.

Lubricant Must Suit Job

Proper lubrication is indispensable and the lubricant should be used generously. Lubricants must have sufficient body to withstand the high pressures and temperatures that will be developed. For spinning heavy stock, oil-bearing lubricants are preferred. For light gages, water soluble lubricants will be found satisfactory. White lead and linseed oil mixed to the consistency of a medium paste is excellent, or lithopone may be substituted for the white lead. Ordinary laundry soap has proven satisfactory for lighter gages and strip. (See the previous article for compositions of lubricants.) Just as after deep drawing, all lubricants must be thoroughly and completely removed before annealing. This must be done with great care, and if an oil-bearing lubricant is used, a hot alkali cleaning solution should be employed to remove final traces of grease. The cleaned piece should be handled with clean gloves, or tongs, to prevent grease smears, or finger prints, burning in during annealing.

Annealing must follow promptly after spinning and removal of lubricant. The importance of this cannot be too strongly emphasized, especially for the austenitic steels.

The stainless steels are well adapted to cold heading for the production of bolts, rivets, nails, cotterpins, screws, and similar products. Any of the grades may be cold headed, although those chiefly used are the straight chromium, regular and "free machining", and 18-8, both regular and "free machining" types. For cold-heading operations these steels are obtainable in coils properly annealed and with a suitable lubricating coating. Either open or closed dies may be used, except for "free machining" types, for which closed dies are preferred.

Pickle Advised After Heading

The customary sequence in cold-heading operation is: cold head, pickle, tumble, roll thread and passivate. In some cases annealing (especially for austenitic steels) may be necessary, and this should precede pickling. Pickling and tumbling are strongly advised after completion of heading operations to remove the lubricating coating which might otherwise induce corrosive attack. Passivation, as a final operation, is necessary for removing all contamination from iron and steel dies which might tend to promote corrosive attack later on.

Draw rolling, in distinction to conventional rolling with driven rolls consists in pulling or drawing strip, or narrow lengths of sheets, through idle deforming rolls of hardened

steel. It is, so far, used almost exclusively for forming parts or members of cold rolled high-tensile austenitic steel as employed in the fabrication of airplanes, rail-cars, marine masts and superstructures. These instructions, therefore, apply only to the austenitic steel, 18-8.

Draw rolling may also be used as a method of production for small sections, such as channels and angles, which are unsuitable, or are required in quantities too small, for the ordinary hot-rolling methods.

Driven rolls have been found unsuitable for forming high-tensile material because of the heavy pressures necessary and the consequent cost of equipment; also because irregularities in the gage or hardness of the strip cause serious distortion.

In draw rolling there is no strain on the material, other than that of forming, and the metal can flow naturally into the desired shape. Further, idle rolling dies permit slippages and avoid difficulties from dragging and sticking that would be encountered in attempting to draw a material like high-tensile 18-8 through fixed dies. Drawing through fixed dies is, however, not completely excluded. It may be used in straightening after the final pass through rolls, and to maintain the shape of the interior of the section, the rolls being used to do the actual forming.

Cold rolled 18-8 strip with tensile strengths up to 185,000 lbs. per sq.in. may be draw rolled successfully in gages from 0.002 to 0.030 in. in practically any desired form. Heavier gages may also be formed, but as the chief use of high-tensile stainless is for purposes of weight saving, heavier gages will less frequently be used.

While almost any type of section may be produced by draw rolling, it is advisable to design sections so as to be symmetrical; also in simple forms which are joined together by spot welding processes into more complicated structural members, as shown in Fig. 1.

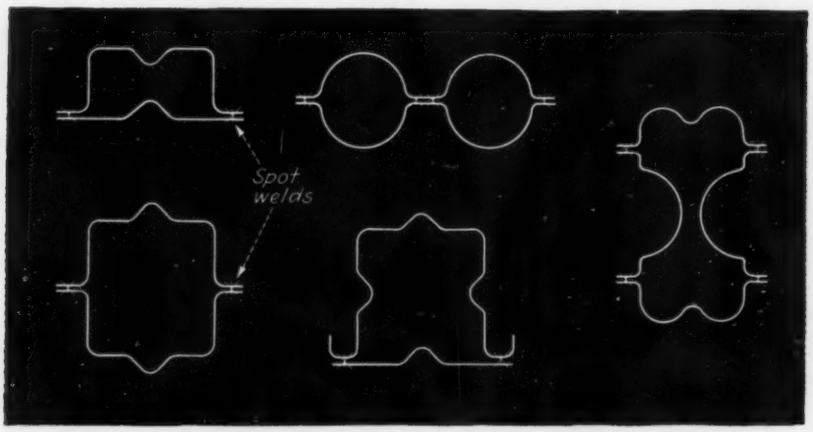


Fig. 1—Draw rolling is best applied to simple symmetrical forms which may be welded together to produce more complicated shapes

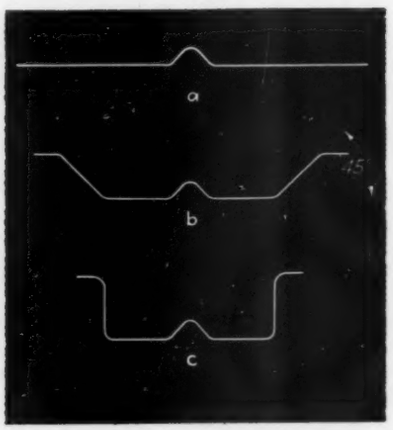


Fig. 2—In draw rolling start at the center of the strip and work outward

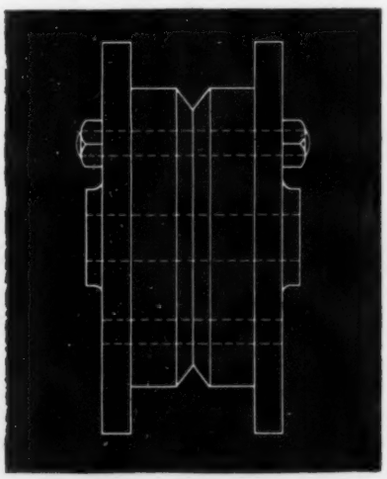


Fig. 3—Built-up rolls are often preferable especially when the insertion of shims or disks makes them available for a variety of work

Rollers are made from cold-rolled steel case carburized, or for severe forming from a good grade of hardened tool steel, as described below. Lubricants are distinctly undesirable in forming light gages with idle rolls. For heavy gages, such as $\frac{1}{8}$ and $\frac{3}{16}$ in., which are now successfully formed by this method, heavy paste lubricants are necessary. Unfortunately, it is difficult to state off-hand the limiting gages for which lubricants should, or should not, be used. Much depends upon the nature and degree of forming to be done. With *fixed dies,* however, lubricants are necessary, and should be used liberally. Rolls will vary in diameter from 3 to 6 in., depending upon the section to be formed. Usually three stands, or sets, of rolls are all that is necessary to form the various sections required. It is best to mount these in separate frames or housings to allow individual adjustments to be made. The axes may be horizontal or vertical as desired.

It is best practice to begin the formation of sections at their middle point with the first set of rolls, continuing through successive sets of rolls and working outwardly toward the edges of the strip, as shown in sketch, Fig. 2 *a, b* and *c*. Bends of greater than 45 deg. should not be attempted in a single pass.

The convex radius on the roll determines the degree of curvature secured on the bead. Therefore, in rolling V-shaped beads, all forming is to be done on the convex rolls, the opposing rolls having a contour designed to allow ample clearance for the formed bead. Spring-back difficulties are avoided by small radii of curvature and by variations in clearance allowance between rolls.

Edge guides are not necessary except for the first pass. The bead formed in this operation is used to guide the partially formed section through successive rolls. In designing rolls it is a good plan to allow greater flange width than is required at the time, as frequently subsequent adoption of a certain shape may call for additional operations on the flange, and in this way the making of a new set of rolls may be avoided.

Rolls may be made solid, or built up as shown in Fig. 3. Various gages and sections may be rolled in this way by replacement of disks, or insertion of shims, as desired. While

the cost of built-up rolls will be high, this will be justified by greater flexibility. However, the production of standardized sections will obviously be simplified by the use of solid one-piece rolls.

The draw bench should be of conventional design with heavy chain to avoid chatter. The chain should be provided with shear pin which will give way in the event of jamming and so prevent damage to spindles and gears. Power should be electric with sensitive speed control. Speed control device should be located near the rolls so as to be convenient to the operator who observes the passage of the strip through the rolls. Control must be accurate and close so the drawing speed can be varied within small limits. Drawing speeds of 40 to 60 ft. per min. should be provided for, but the speed is relatively independent of the size of the section being rolled.

Roll Mounting and Design

Rolls should be mounted at the end of the bench on a plate or base of sufficient massiveness to avoid vibration. Each stand of rolls is mounted in separate housings with adjusting screws to vary the distances between each pair of rolls. Separate housings are desirable in order to permit shifting about for adjustment. Stands are placed close together for convenience.

Much of the success of the operation of draw rolling depends upon the design of the rolls. These should be designed to allow a minimum clearance of 0.002 in. at all points, the maximum clearance depending on the shape of the section. Avoid very sharp curves at inner radii of rolls to prevent cracking and fracture during heat treatment for hardening.

The following procedure for preparing rolls is suggested:

1. Rough turn.
2. Normalize, if alloy or high carbon steel, to produce homogeneous and uniform structure in the steel.
3. Finish turn to proper size and shape. For greater precision use templets for machining the contour of both rolls. Greater accuracy will be secured in this way than by attempting to machine to exact specified dimensions. Finally polish off tool marks on edges and sides.
4. Rough drill center hole to slightly undersize.
5. Carburize and heat-treat, or heat-treat according to instructions for particular type and grade of steel used.
6. Grind center hole to size. The hardened roll should be alligned in the grinder (with a dial indicator) as accurately as possible with respect to the exterior surfaces. If a non-deforming tool steel has been used it should not be necessary to grind exterior surface. If much deformation has taken place, due to hardening, then exterior surface must be ground to accurate profile by templates, using the finished center hole as a bearing for the mandrel.

In draw-rolling procedure the first operation is to pass the strip, which has been accurately slit to correct width, through an edge trimmer made from a series of disks of hardened steel mounted perpendicular to the plane of the strip at each edge, similar to the popular disk knife sharpener. This will remove all burrs. The strip is then passed through a wiper made by wrapping heavy cloth, or canvas, around two bars which are clamped together with the strip between them. The strip must be thoroughly clean, free from grease, chips, and particles of grit which might mark the rolls.

The strip then enters a suitable guide placed close to the first set of rolls, and from this to the rolls themselves which are separated to allow the strip to pass through flat. As the strip passes through the rolls they are then tightened. When the first formation passes the second set of rolls these are also tightened gradually as the strip progresses, and similarly with the remaining sets of rolls, until the final shape of the section has been obtained. The first set of rolls should be clamped firmly to the foundation plate at the start, the others being free to align themselves. They are then clamped down with the strip under tension.

Camber, or twist, in the formed section after leaving the finishing rolls may be corrected by adjustment of rolls and their housings, or a straightening device may be used. This is a simple form, made of wood in two halves, and carefully shaped to conform to the finished section. As the section leaves the final rolls with twist, this form may be set in such fashion as to correct it. It should be well lubricated.

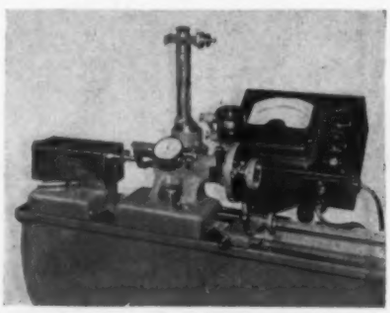
Formed sections are cut to length with a high velocity bandsaw having fine or blunted teeth, or with one of the narrow face high velocity bonded cutting off wheels.

In designing rolls and sections for joining by spot-welding processes, it should be noted that these permit the use of much narrower flanges than could be used in riveting. While there are no hard and fast specifications, the fused area in a properly made spot-weld should not exceed in diameter three times the total thickness of the material being welded. The minimum flange width, in turn, should be three spot diameters. This will allow space for fabrication.

Millionths of an Inch

Millionths-of-an-inch differences in gage lengths can be compared electrically on a standard measuring machine in the Tool and Gage Department of General Electric's plant in Schenectady. Originally built to measure mechanically to 0.00001 in. gages up to 80 in. long, and to compare extremely small differences in length, such as may exist between toolroom standards and factory gages, this machine has been improved through the addition of a sensitive electric gage mounted on the movable tailstock as shown in the illustration.

Essentially, the machine consists of a heavy bedplate with a movable headstock at one end and the improved movable tailstock at the other end. Differences in length over 0.00001 in. are measured mechanically at the headstock, while millionth-of-an-inch differences in length are compared at the tailstock. The electric gage also is used in setting the pressure on the gage standard whose length is being checked at the headstock. The head of the electric gage is mounted in such a way that the gage spindle is made the tailstock spindle. This makes the gage-head spindle responsive to the slightest variations in gaging pressure.



An electric gage-head fitted to the movable tailstock of this measuring machine helps General Electric gage makers to compare lengths of gage standards within a millionth of an inch in regular toolroom practice

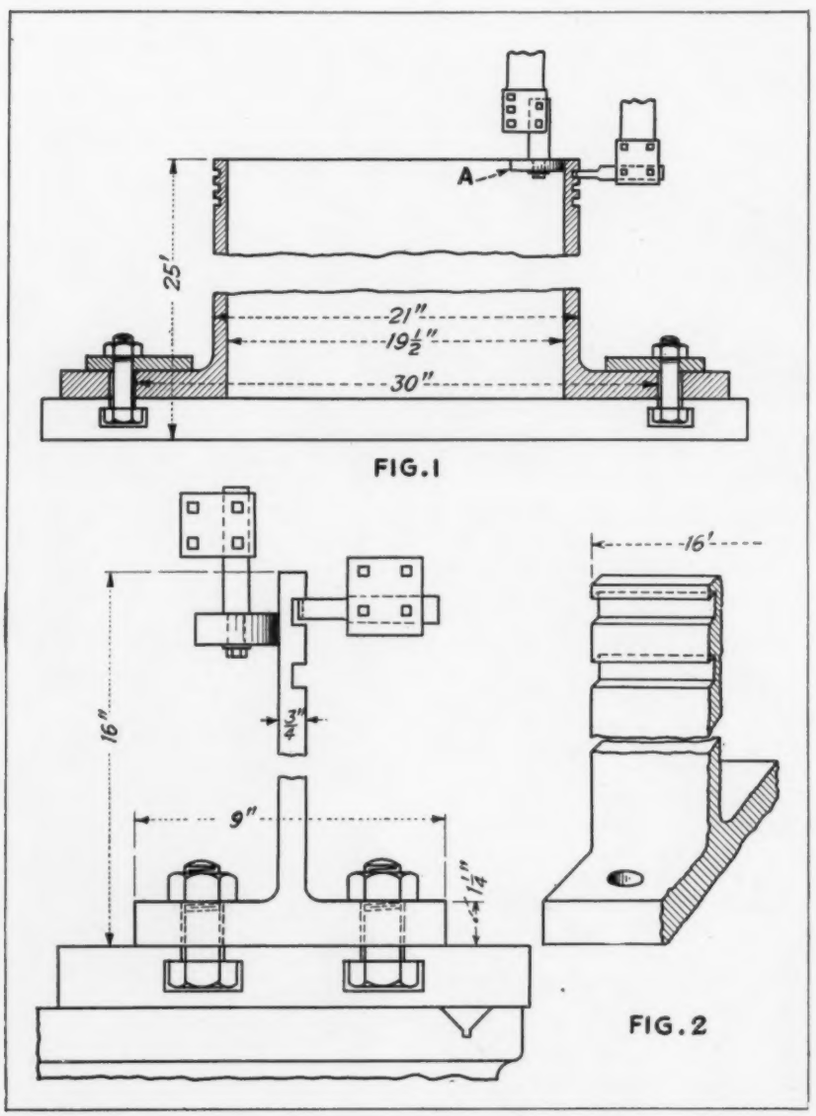
IDEAS FROM PRACTICAL MEN

Roller Support

By ARTHUR SILVESTER

In machining a quantity of pot castings in a vertical boring mill, as shown in Fig. 1, we were troubled with chatter, no matter how the tool was ground. The castings were comparatively thin in proportion to their height and we attributed the chatter to their springing away from the tool under pressure of the cut. Finally, we mounted the roller *A* on a bar held in the idle head and brought the roller against the inner wall of the work, backing up the casting against the thrust of the cut. That stopped the chatter.

In Fig. 2 is shown another example of backing up the work by a roller. In cutting grooves in side frames 16 ft. long, 16 in. high and ¾ in. thick, the work would spring away from the tool, especially at the start and finish of the cut. A roller mounted on a bar held in the idle head was used to back up the work. By its use we were able to take much heavier cuts and do a better job.



Work that is comparatively thin in proportion to its length or height will stand heavier cuts without springing if backed up by a roller

Fixtures Hold Work Parallel With Table

By JOHN W. GERDEL

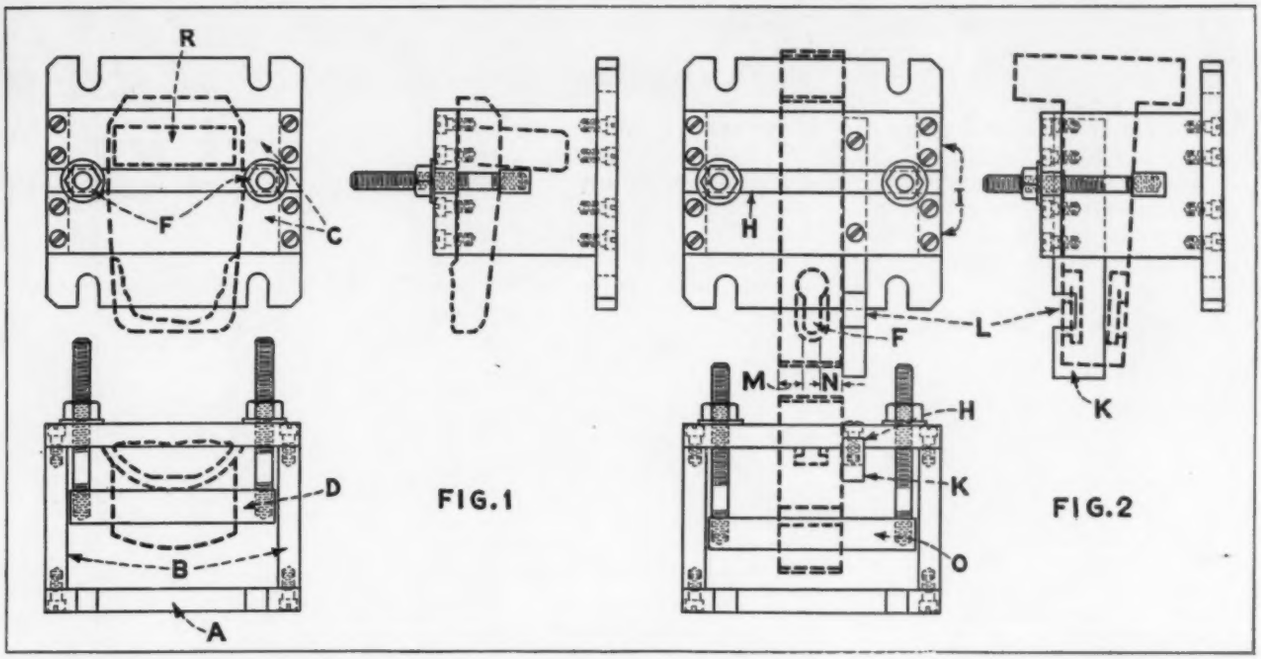
The work shown in heavy dotted lines in the fixture illustrated in Fig. 1 is part of a permanent mold for aluminum castings. It is made of a high grade of cast iron similar to Mechanite. The great heat to which the mold is subjected has caused part of the sharp edge to crumble, and to restore it to its original condition it is built up by depositing welding metal. The rough surface left by the welding operation is milled to its original level by an end mill in a vertical milling machine.

Essentially, the fixture consists of the base *A*; the two uprights *B*; the two top pieces *C*; the strap clamp *D*; and the necessary studs, screws, washers and nuts.

After the uprights have been attached to the base, their tops are surface ground to bring them parallel with the bottom of the base, then the two top pieces are attached to the uprights. The undamaged part of the surface of the work is held against the undersides of the top pieces by the strap clamp, bringing it parallel with the machine table.

The fixture shown in Fig. 2 is for holding another part of a mold for aluminum castings for milling the key slot *F* in opposite sides. It is essential that the key slot be in line with the sides of the work, square and parallel with the surface in which it is milled, and accurately in its middle. The construction of the fixture is similar to that of the fixture shown in Fig. 1, so that a description is not necessary.

A slot is cut at *H* in the undersides of the top pieces *I* into which is fitted the steel key *K*. The key extends some distance beyond the sides of the fixture so that it can be indicated for parallelism with the slide



While both fixtures are built along the same general lines and the method of holding the work parallel with the machine table is the same, they differ in some of the details

of the machine in which the work is done. A crosswise recess is cut in the key at *L* so that the dimensions *M* and *N* can be measured with a micrometer.

The work is held lightly against the under sides of the top pieces and is clamped to the key with toolmakers' clamps, then the strap clamp *O* is pulled up tightly. After the key slot has been milled in one side of the work, the work is removed and then clamped with opposite side up so that a duplicate of the keyslot can be milled in that side.

With lots running from six to a dozen pieces, quite a saving is made by the use of the fixture.

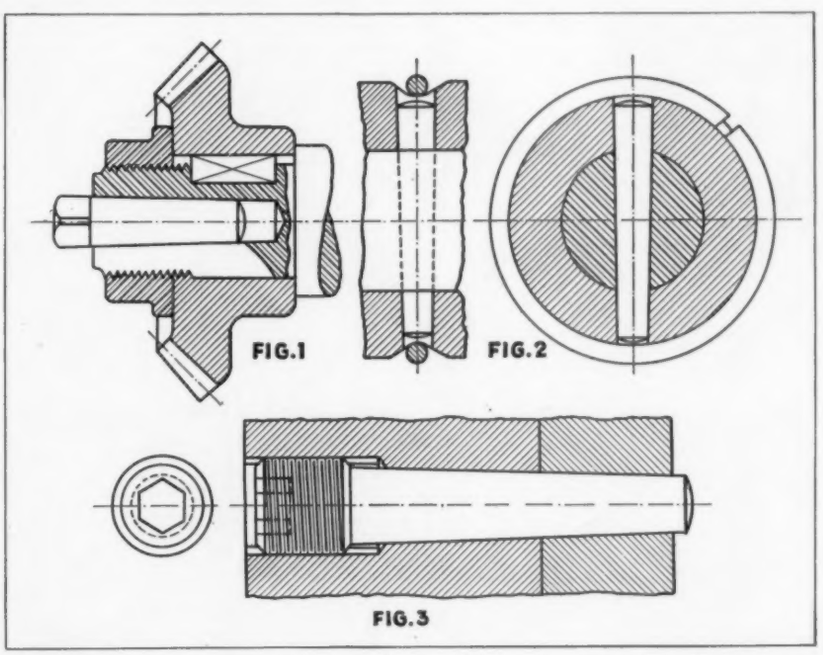
Taper Pins and Their Applications

By F. A. FIRNHABER

Referring to the article by F. H. Martin under the above title (*AM*—Vol. 83, page 88) other applications of and means for retaining and adjusting some of the taper pins described by him have come to mind. For instance, the square-head taper pin shown in Fig. 1 of Mr. Martin's illustration can be used to lock a flanged hex nut holding a small bevel gear on a shaft, as shown in Fig. 1 of the accompanying illustration. The threaded end of the shaft has three equally spaced saw cuts reaching almost to the shoulder. The taper pin is driven home after the nut has been tightened against the gear, expanding the threaded end of the shaft and locking the nut securely. The advantage of this application is that the square head of the pin occupies less space than would a locknut.

In Fig. 4 of Mr. Martin's illustration the taper pin at *A* is retained by a snap ring fitting in a groove in the small end. In Fig. 2 of my illustration is shown how a gear, cam, pulley or other member can be fastened on a shaft and how the taper pin can be retained, even though it becomes loosened in its hole. One coil of a helical spring fits in a groove in the hub of the member with its ends apart when in position. The groove is wide enough to permit a screw driver or other prying tool to be inserted to snap off the ring when desired.

In Fig. 6 of Mr. Martin's illus-



Application of and means for retaining and adjusting taper pins for tightness differing from some of those described in AM—Vol. 83, page 88

tration, two separate screws are used to adjust a taper pin for tightness, one at each end. Fig. 3 of the accompanying sketch shows a different and simpler method. The large end of the pin is enlarged in diameter and has a fine thread cut on it. Also it has a hex socket for a wrench. The tapped hole in the held member extends beyond the thread on the pin to permit endwise adjustment.

Press Tools for Bending

By H. B. WILSON

The press tools illustrated are for bending the wings of the cross-shaped blank in Fig. 2 at right angles to its center, two downward and two upward, at one stroke of the press. The finished piece, shown in Fig. 3, is made of quarter-hard brass.

The lower member of the tools consists of the combined forming punch and pressure pad *A*, the two die sections *B*, the strippers *C*, the locating gages *D*, and the necessary springs and pins for operating the pressure pad. The upper member consists of the punch *F* only.

In operation, the blank is placed on the die sections and is located by the gages. As the ram descends, punch *F* bends two wings downward over the pressure pad, the spring pressure being strong enough to permit the bend to be made before the pressure pad begins to descend. As the ram continues its descent, the pressure pad and the partly formed piece are pushed down to the position shown in Fig. 4. In Fig. 5 the pressure pad has bottomed on the die shoe and the other two wings have been bent upward between punch *F* and the die sections. On the upward stroke of the ram, the strippers strip the finished piece from punch *F*.

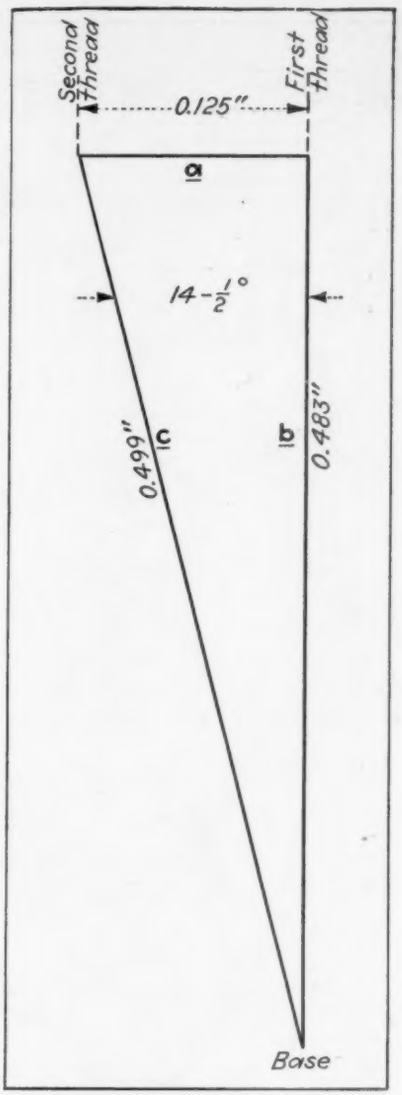
An unusual feature of the tools is the provision for insuring accuracy in the lengths of the legs in the downward bend, since that is very important. The overall distance of the wings to be bent downward is made several thousandths longer than would otherwise be necessary to insure there being enough metal for the required length of the legs. Referring to Fig. 5 it will be seen that when the ram is almost at the bottom of its downward stroke, the lower ends of the legs contact the upper edges *H* of the hardened guides, tending to upset and push upward any surplus metal in the legs and thus control their length.

Cutting Multiple Threads

By E. N. OLSON
Toolmaker, Philadelphia Navy Yard

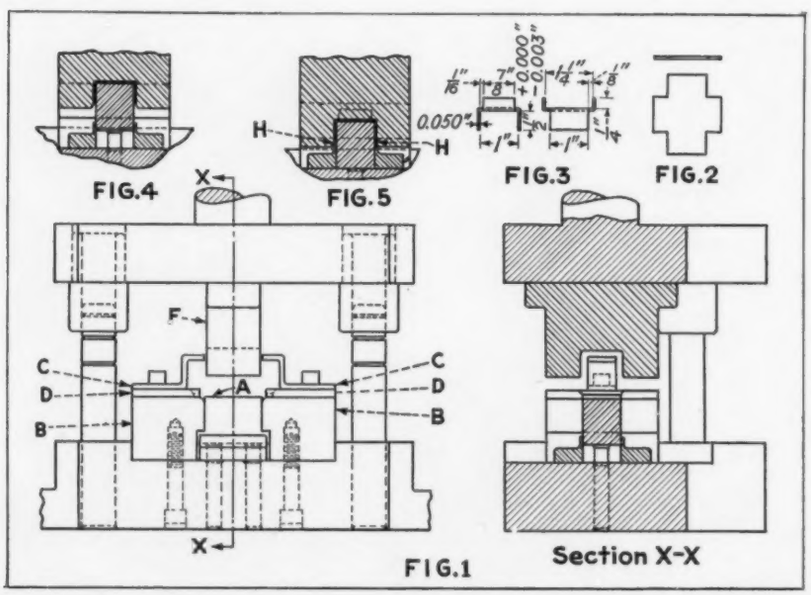
Screws having very good multiple threads can be cut by a practical application of the right-angle triangle and without being indexed by any of the conventional methods.

For example: For cutting a double-thread Acme screw having a lead of 0.250 in., first draw a right-angle triangle of 14½ deg., as illustrated. Let side *a* represent one-half of the lead, or 0.125 in., side *b* represent movement of the toolblock on the cross-slide; and side *c* represent movement of the tool by the compound rest.



This triangle represents the movement of the tool by toolblock and compound rest in cutting a double-thread Acme screw of 0.250-in. lead.

With the lathe geared for cutting a screw of 0.250-in. lead, proceed as follows: Set the compound rest at an angle of 14½ deg. to the cross-slide and feed the tool inward until its point just scratches the surface of the work. Set the micrometer collars on the cross-feed and compound-rest screws to zero. Then cut the first of the two threads to its correct depth, using the compound-rest mechanism. Bring the slide of the compound rest back to the original starting point and move the toolblock outward on the cross-slide 0.483 in. (side *b* of the triangle). Then feed the tool inward 0.499 in. by the compound rest (side *c* of the triangle), at which time its point will just scratch the work midway between any two of the first threads cut and is in position for cutting the second thread.



The wings of the blank are bent at right angles to its center, two downward and two upward, at one stroke of the press

Nomenclature—Single-Point Cutting Tools

Approved by the Sectional Committee on Small Tools and Machine Tool Elements under A.S.A. procedure and sponsored by S.A.E., A.S.M.E. and the National Machine Tool Builders' Association

1 TOOL ELEMENTS

1a Size. The size of a tool of square or rectangular section is expressed by giving, in the order named, the width of shank, the height of shank, and the total tool length, in inches, such as $\frac{3}{4} \times 1\frac{1}{2} \times 12$ in. The same method of designation is used for tool bit holders to which is added the size of the bits.

1b Shank. The shank is that part of the tool on one end of which the point is formed or the tip or bit is supported. The shank in turn is supported on the toolpost of the machine, Figs. 1, 2, and 3. (See American Standard for Tool Holder Shanks and Tool-post Openings, B5b-1929.)

1c Base. The base is that surface of the shank which bears against the support and takes the tangential pressure of the cut, Figs. 1, 2, and 3.

1d Heel. The heel is the edge between the base and the flank immediately below the face, Figs. 1, 2, and 3.

1e Face. The face is that surface on which the chip impinges as it is cut from the work.

1f Point. The point is all that part of the tool which is shaped to produce the cutting edges and face.

1g Cutting Edge. The cutting edge is that portion of the face edge along which the chip is separated from the work. The cutting edge consists usually of the side-cutting edge, the nose radius, and the end-cutting edge, Figs. 1, 2, 4, and 5.

1h Nose. The nose is the curve formed by joining the side-cutting and end-cutting edges.

1i Shape. The shape of the tool is the contour of the face when viewed in a direction at right angles to the base.

1j Flank. The flank of the tool is the surface or surfaces below and adjacent to the cutting edge, Fig. 1.

1k Neck. The neck is an extension of the shank of reduced sectional area. A relatively small point, as required in boring, is sometimes attached to the shank by a neck, Fig. 4.

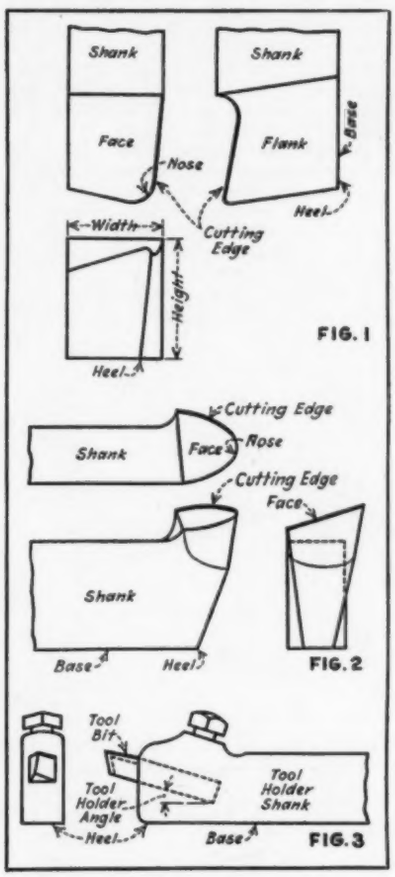
1l Flat. The flat is the straight portion of the cutting edge intended to produce a smooth machined surface, Fig. 5.

1m Chip Breaker or Control. The chip breaker is an irregularity in the face of a tool, or a separate piece fastened to the tool or tool holder, to cause the chip to break into short sections or curl, Fig. 6.

2 TYPES OF TOOLS

2a Ground Tool. A ground tool is one in which the point is formed on the end of a bar (shank) of tool steel by grinding, Fig 1.

2b Forged Tool. A forged tool is one in which the point is forged roughly to shape on the end of a bar (shank) of tool steel before hardening and grinding, Fig. 2.



2c Tipped Tool. A tipped tool is one with a tip of cutting material, permanently attached to a shank of non-cutting material. The tip is ground to form the cutting edges and face of the tool, Figs. 5 and 6.

2d Curved Cutting Edge Tool. A curved cutting edge tool has variable side-cutting-edge angles, Fig. 2.

2e Raised Face Tool. A raised face tool is one having its face above the top of the shank. Forged tools, as in Fig. 2, frequently have the face raised above the shank top so that less material need be removed in regrinding the point. The details of forged tools should be shown by drawings.

2f Bit Tool. A bit tool is one in which small parts of the tool materials, of square, rectangular, or other section, or forged to special shapes, are held in the end of a holder or shank, Fig. 3.

2g Tool Holder. A tool holder is a tool shank designed to hold a removable point or tool bit, Fig. 3.

2h Tool Bit. A tool bit is a relatively small piece of cutting material, clamped in a tool shank or holder in such a way that it can readily be removed and replaced, Figs. 3, 7b, and 9.

2i Straight Tool. A straight tool has the point on the forward end of a straight shank, Figs. 1 and 5.

2j Bent Tool. A bent tool has the point bent to the left or right, Figs. 7a and 7b, to make its operation more convenient. These tools are called left-bent tools if the point is bent to the left when looking at the tool from the point end with the face upward and the shank pointing away and vice versa.

2k Offset Tool. An offset tool has the point at either side of, but parallel to, the shank. It is known as a right-offset tool if the point is offset to the right of the shank when looking at the tool from the point end with the face upward and the shank pointing away. Fig. 8 illustrates a left-offset tool.

2l Right-Cut Tool.[1] A right-cut single-point tool is one which when viewed from the point end of the tool, with the face up, has the cutting edge on the right side, Figs. 1, 2, 4, 7a, 7b, and 10.

2m Left-Cut Tool. A left-cut tool has the cutting edge on the left when looking at the point end with the face upward, Figs. 5, 6, 8, and 9.

2n End-Cut Tool. An end-cut single-point tool is one having its principal cutting edge on the end.

3 TOOL ANGLES

3a Tool Holder Angle. The tool holder angle is that angle between the bottom of the bit slot and the base of the tool holder shank, Fig. 3.

3b Shank Angle. The shank angle is the angle by which the point of a bent tool deviates from the straight portion of the shank, Figs. 7 and 12.

3c Back-Rake Angle. The back-rake angle is the angle between the face of a tool and a line parallel to the base of the shank or holder measured in a plane parallel to the center line of the point and at right angles to the base. The angle is positive if the face slopes downward from the point toward the shank and is negative if the face slopes upward toward the shank, Fig. 9.

3d Side-Rake Angle. The side-rake angle is the angle between the face of a tool and a line parallel to the base. It is measured in a plane at right angles to the base, and at right angles to the center line of the point, Fig. 9.

3e Relief Angle. The relief angle is the angle between a plane perpendicular to the base of a tool or tool holder and the ground flank immediately adjacent to the cutting edge, Figs. 5 and 9.

[1] When such a tool is used in an engine lathe, the cutting edge is on the left side. It is fed into the work from right to left, as when cutting a right-hand screw thread.

Nomenclature—Single-Point Cutting Tools

3f Side-Relief Angle. The side-relief angle is the angle between the portion of the flank immediately below the cutting edge and a line drawn through this cutting edge perpendicular to the base. It is measured in a plane at right angles to the center line of the point.

3g End-Relief Angle. The end-relief angle is the angle between the portion of the end flank immediately below the cutting edge and a line drawn through that cutting edge perpendicular to the base, Figs. 5 and 9. It is measured in a plane parallel to the center line of the point.

3h Clearance Angle. The clearance angle is the angle between a plane perpendicular to the base of a tool and that portion of the flank immediately adjacent to the base. The side clearance angle is measured in the plane of the side-rake angle. The end clearance angle is measured in the plane of the back-rake angle, Fig. 5.

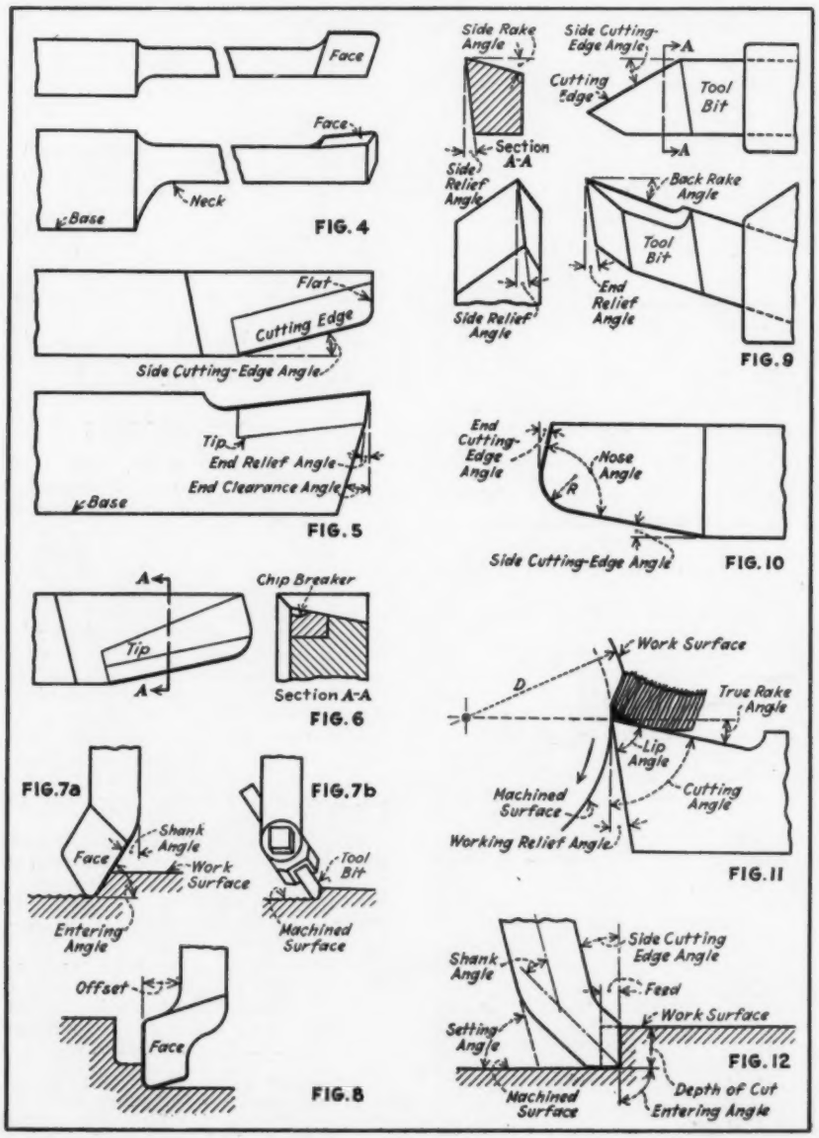
The surfaces of the tool below the cutting edge are usually forged or rough ground before hardening so as to reduce the amount of grinding on the flank, Fig. 2. The ground flank sometimes extends to the heel, Fig. 1, in which case there is no clearance.

3i Side-Cutting-Edge Angle. The side-cutting-edge angle is the angle between the straight side-cutting edge and the side of the tool shank, Figs. 9 and 10. In the case of a bent tool this angle is measured from the straight portion of the shank, Fig. 12.

3j End-Cutting-Edge Angle. The end-cutting-edge angle is the angle between the cutting edge on the end of the tool and a line at right angles to the side edge of the straight portion of the tool shank, Fig. 10.

As the setting angle is changed, the relation of the end-cutting edge to the work also is changed. See under "Working Angles."

3k Nose Angle. The nose angle is the angle included between the side-cutting edge and end-cutting edge, Fig. 10.



4 WORKING ANGLES

4a Working Angles. The working angles are those angles between tool and work, which depend not only on the shape of the tool, but also on its position with respect to the work, Fig. 11.

4b Setting Angle. The setting angle is the angle made by the straight portion of the shank of a tool with the finished surface of the work, Fig. 12.

4c Entering Angle. The entering angle is the angle which the side-cutting edge of a tool makes with the plane of the finished surface of the work, Figs. 7a and 12.

4d True-Rake Angle. The true-rake angle (or "top-rake"), under actual cutting conditions is the actual slope of the tool face toward the base from the active cutting edge in the direction of chip flow. It is a combination of the back-rake and side-rake angles and varies with the setting of the tool and with the feed and depth of cut, Fig. 11.

4e Cutting Angle. The cutting angle is the angle between the face of the tool and a tangent to the machined surface at the point of action. It equals 90 deg., minus the true-rake angle, Fig. 11.

4f Working-Relief Angle. The working-relief angle is the angle between the ground flank of the tool and a line tangent to the machined surface passing through the active cutting edge, Fig. 11.

4g Working-End-Cutting-Edge Angle. The working-end-cutting-edge angle is the angle between the straight-end-cutting-edge and a plane tangent to the machined surface at the point of cutting.

4h Lip Angle. The lip angle is the included angle of the tool material between the face and the ground flank measured in a plane at right angles to the cutting edge. When measured in a plane perpendicular to the cutting edge at the end of the tool, it is called the end lip angle. When measured at the point of chip flow, it is called the true lip angle, Fig. 11.

5 GENERAL TERMS

5a Cutting Speed. The cutting speed is the peripheral or surface speed of the work with respect to the tool. In turning, it is usually measured on the uncut or work surface of the work ahead of the tool. See Fig. 11.

Example: Cutting speed S in turning in fpm $= 3.1416\ D\ N$, in which

D = diameter of work in feet

N = revolutions per minute of work.

P-R-O-F-I-T-S Spells Prosperity

MR. A has idle money to invest. New industries, new opportunities in old industries, tempt him. But there's no use in playing for big stakes under today's rules. If he loses, he is out his investment. If he wins, he pays a handsome share of his earnings to the government. He is lucky to come out with a modest addition to his funds.

So Mr. A thinks the gamble isn't worth the price. He keeps his money socked away in government bonds or resting in a bank account at a paltry rate of interest, though it galls him to do it.

If you can visualize thousands of Mr. A's around the country, you can understand one of the chief ailments in the United States just now. The incentive to make big capital outlays and thus stir the heavy goods industries into action isn't there. So long as the government does nothing to restore the incentive, the impasse will continue.

Industry recognizes this fact. Business groups agree that the tax structure should be revised to give the profit system a better chance of working. The National Association of Manufacturers thinks so. The United States Chamber of Commerce thinks so. The American Federation of Little Business thinks so. Independent agencies, like the Brookings Institution, think so.

You do not have to look farther than New Deal circles to find those who believe that the flow of capital into private business today is frozen by the government's own doings. Secretary of the Treasury Morgenthau, who has always been a loyal Rooseveltian, invited Congress back in February to look at the tax laws to see if they are "holding the business man back from making future commitments."

One government official privately summed up the situation as follows, "No profits—no progress. Profits of $100,000 will readily make possible the purchase of up to $2,000,000 of goods. No other force except profits, under our capitalistic economy, allows the dollar to multiply itself."

Why not do some plain talking on this subject? The fact is that the man with money to invest today wants a sporting chance to make some more with it. He doesn't demand a "killing." He is willing to pay the government a fair share of it. But he isn't willing to invest when the government keeps turning the tax heat on him constantly and may even increase the intensity of the heat tomorrow.

The United States was built up under a system of private enterprise. No responsible government official, from the President down, has done other than declare allegiance to that system. Yet the present tax set-up doesn't give it a fair chance.

Isn't it time that we recognize that P-R-O-F-I-T-S and not P-E-N-A-L-T-I-E-S spells PROSPERITY?

Burnham Finney

GAGING BUSINESS

Better foreign sales outlook fails to offset increased uneasiness due to labor troubles and government inertia. Machine tool index drops 30 points.

Though machine tool sales continue in fairly healthy volume, considerable uneasiness exists in machinery circles. For one thing, too large a proportion of current orders comes from foreign sources or from the government rather than from private industry. Moreover, the feeling is growing that Congress will not enact at this session any important legislation helpful to business. The Machine Tool Index for April was down to 155.6, compared with 185.4 in March. Considerably more foreign machinery business is in sight, especially from France and Russia. Government purchases also will be large in the months immediately ahead. Shipbuilding, aircraft and aircraft parts, railroad equipment, farm implements and ordnance products are the most active sectors in the metalworking industry. Spotty conditions prevail around the country, many plants running more than one shift and others relatively flat because of lack of orders.

NEW ENGLAND—Army, Navy and private shipyards continue active as buyers of machinery. Springfield Armory has purchased more machinery. Indian Motorcycle has won a sizable contract from the War Department. Motor and electrical control equipment sales are expanding. A contract has been placed for $600,000 of electric equipment for a paper mill. Tool steel bookings are up.

NEW YORK—Shipyards are working at full capacity and builders of marine equipment, such as turbines, are busy. Factories making precision aircraft parts are running on multiple shifts. Auto parts companies, on the other hand, are curtailing operations as the tag end of the season approaches. Amtorg is expected soon to inquire for a large number of machine tools. A French mission also will buy equipment for French plants awarded educational orders. Heavy press makers are busy filling foreign orders.

PITTSBURGH — Steel operations have gradually declined the past month from 52.1 per cent to 47 per cent. A further drop is looked for. No improvement is likely until automobile companies place initial releases for 1940 models late in June. Industrial production locally is lower than in April, but above a year ago. Sentiment in machinery circles is at low ebb.

CLEVELAND—Industrial employment has decreased slightly. Steel output is good compared with the industry as a whole. Machinery builders have had a fair influx of orders.

DETROIT—General Motors has let equipment orders costing $2,000,000 for it's new automatic transmission plant here. Machine tool business otherwise is dull. Aircraft parts makers have had on hand a six-months' backlog. Ford is down to four days a week.

CHICAGO—Some dealers report machinery sales better this month than in April. Farm implement orders are running ahead of a year ago. Railroad equipment buying is active. Denver & Rio Grande Western will purchase 550 freight cars. Chicago & Northwestern is planning to buy 820 freight and passenger cars, while Santa Fe has ordered 30 switching locomotives. Electro-Motive Corp. is operating full blast three shifts a day. Rockford machine tool companies are doing well, sustained considerably by foreign orders.

TOLEDO—Though machine tool purchases have been 10 per cent ahead of 1938, current orders are slack. Auto parts factories have about completed 1938 model runs.

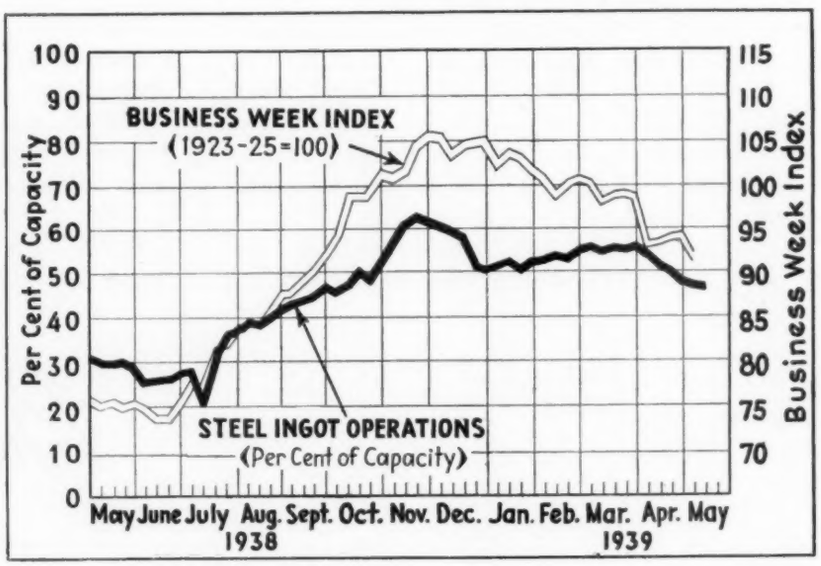
INDIANAPOLIS — Allison Engineering has been awarded 800 V-12 aircraft engines by the War Department. Cummins Engine Co. is reported about to purchase considerable equipment.

MILWAUKEE—Allis-Chalmers has been awarded large turbines for Shasta Dam power plant in California at cost of $1,843,000, a 50,000-kw. turbine for Commonwealth Edison at Chicago, and a $750,000, flour mill at Spokane, Wash. Harley-Davidson will furnish the War Department 381 motorcycles costing 172,590. Waukesha Motors will be busy 40 hr. a week through July on initial order of 5,000 motors for the new Crosley car.

CINCINNATI—Foreign and government business is sustaining machine tool builders at a good rate. At Dayton the National Cash Register Co., Frigidaire and Master Electric are on much better schedules than a year ago.

STEEL PRODUCTION VS. GENERAL BUSINESS

The Spring break in automobile steel buying is reflected in current ingot production, which will probably remain below 50 per cent for some time



NEWS OF THE INDUSTRY

MORE LABOR STRIFE PROBABLE AS RESULT OF U.A.W. BATTLE

DETROIT—Automotive labor is quiet, but trouble looms ahead at plants where the Martin and Thomas factions of the United Automobile Workers can claim membership. Both groups, for example, expect to demand a new contract of General Motors. So far G.M. has been exceptionally free from even minor demands and from production interruptions.

Militant U.A.W.-C.I.O. local leaders have caused shutdowns of departments and entire plants at Chrysler. Controversy arose originally over the union's claim that Chrysler had exceeded its right to exempt 10 per cent of its employees from seniority rules. There were periodic walkouts, pulling of switches and extended negotiations while union officers tried to get trouble-makers off without punishment.

Briggs, now negotiating a contract, had two shutdowns when men refused to get tools from cribs before starting a shift, arguing that 15 minutes should be allowed during working hours to get tools and a like period for returning them. The men are back at work under the old arrangement pending a new contract.

Some auto makers have asked union officials to hold new employee elections to determine which faction is entitled to speak for the workers, but nothing has happened thus far. Off-record conversations with both union and management people usually produce the question, "Can Homer swing it?" The answer is, "Probably not, but——", with the "but" thrown in to lead up to discussion of the factions-within-a-faction difficulty which bothers the C.I.O. section of the U.A.W. Up to now, the C.I.O. side is reported to have had the big majority of members.

Half the former U.A.W. vice-presidents who failed of reelection at the C.I.O. Cleveland convention are back on the union payroll as organizers. The other half probably will fare well, too. The injunction suit to determine whether the Martin or Thomas faction can legally use the U.A.W. name and shall have possession of the union's books got under way last week after a three-months' delay. The winner will inherit a $100,000 debt to the C.I.O., an offsetting bank balance of about $60,000 and back rent due on headquarters.

Record Peace-Time Preparedness Program Involves Cost Exceeding $2,000,000,000

ALLISON GETS ARMY ORDER

INDIANAPOLIS—A contract for 800 aircraft engines has been awarded by the War Department to the Allison Engine Division of General Motors Corp. For installation in single-motored pursuit ships, the engines are of the V-12 liquid-cooled type and deliver 1,000 hp.

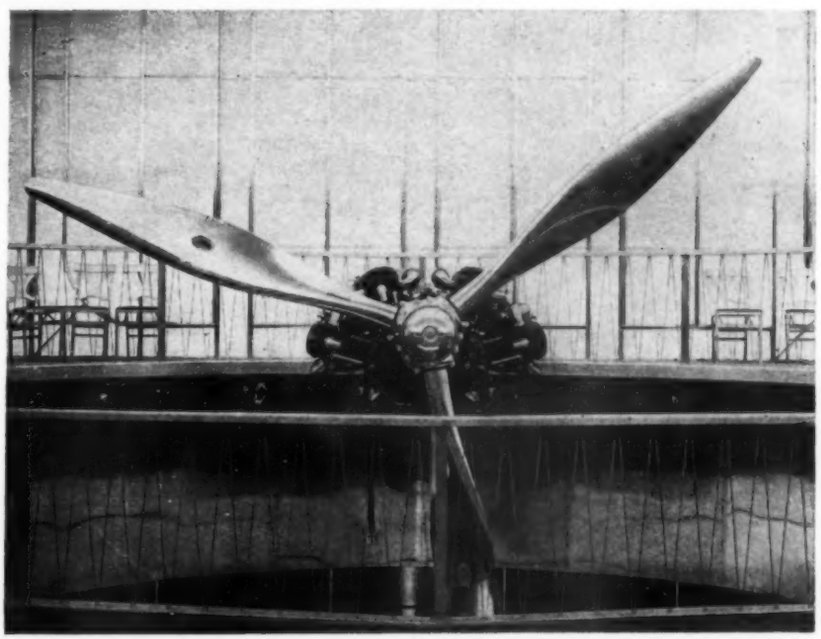
This order provides the first lot which will be manufactured on a straight-line basis in Allison's new $6,000,000 plant, where production is expected to reach twelve engines per day. The company has turned out about 100 similar motors for the Army with existing facilities, and is still working on small orders from Britain and an appreciable number to be delivered to France.

Nearly $1,500,000,000 Already Appropriated; Placing of Orders Under Way

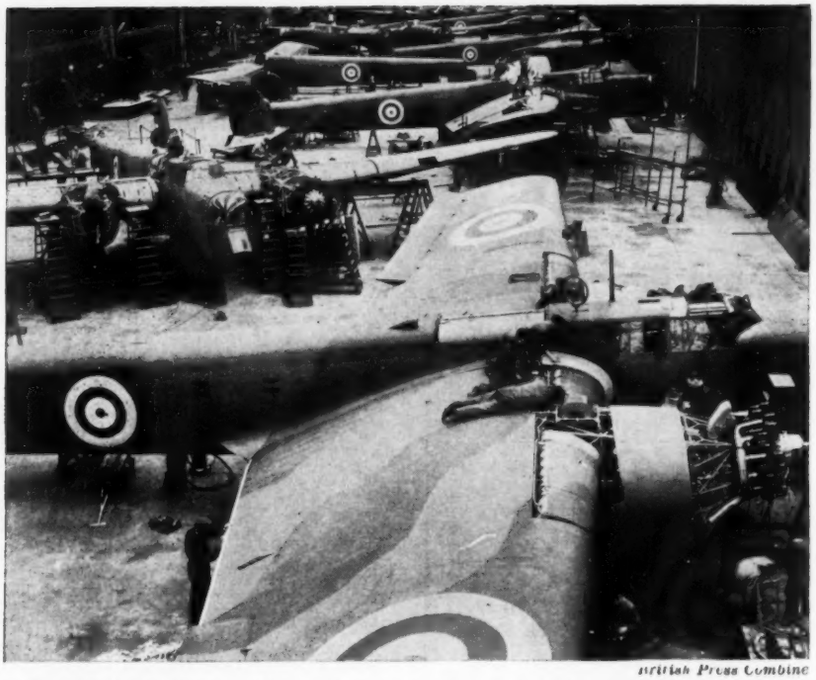
By BLAINE STUBBLEFIELD
McGraw-Hill Washington Bureau

WASHINGTON—All peace-time defense spending records will have been broken when Congress completes its present preparedness program. Total cost of strictly military enterprises will pass $1,700,000,000. Quasi-defense projects, such as naval auxiliary ship building, rivers and harbors improvements, and civil works administered by Army and Navy, will carry the figure past the $2,000,000,000 mark. Appropriations to the first of May added up to $1,421,108,873.

Regular supply bill for Navy, 1940, totals $770,473,241, which is $143,000,000 more than this year's funds, but $20,000,000 less than budget estimates. It carries $50,000,000 for new ship



Giant Power Plant—*On display at the New York World's Fair is this 2,000-hp. 24-cylinder liquid-cooled aircraft engine built by the Allison Engineering Division of General Motors. Said to achieve the lowest weight per horsepower of any engine in the world, it is similar to the 800 V-12 type motors recently ordered by the War Department*



British Press Combine

Wings for Attack—*Although British aircraft activity is mainly concerned with defense, the Aircraft Ministry is also strengthening the reserve of counter-offensive planes. Here Whitley bombers are in the final stages of construction in the Armstrong-Whitworth works at Coventry. Ships are designed for mass production of numerous structural units, such as wing ribs and fuselage members*

construction; $24,422,000 for repair and construction; $31,948,000 for ordnance and ordnance stores; $52,381,000 for shore works; $83,298,000 for aviation; $254,204,000 for replacement of vessels, which includes $207,593,000 for construction and machinery and $40,611,000 for armor and armament.

For Overhauling Biggest Battleships

Improvement and enlargement of the Panama Canal would be authorized by a bill reported by the House Merchant Marine Committee. Total cost would be $227,000,000. Only $15,000,000 could be appropriated for 1940.

Major overhaul of four 35,000-ton naval vessels (*California, Colorado, Maryland,* and *West Virginia*) would be authorized at a cost of $6,600,000 plus $450,000 for each vessel for each 18-month period under a bill introduced and unanimously reported by Senate Naval Affairs. Estimated total cost—about $100,000,000. All are on the Pacific Coast and the work probably will be done at the Puget Sound yard.

Aviation Expansion Begun

The President has asked Congress to appropriate $277,000,000 in cash to go ahead with the 6,000-airplanes program authorized by the Army Expansion Act of April 3, in conformity with his defense message of January 12.

Fifty million dollars of the $300,000,000 authorized was carried in the regular Army supply appropriation of 1940, and the War Department last fortnight awarded contracts for 571 planes, minus engines and accessories, at a cost of $20,000,000. The rest of the $50,000,000 is to be spent by the Department itself for engines and accessories in quantity lots, which will be turned over to manufacturers for installation. Few days ago the first of the government orders was placed: for 800 Allison V-12 liquid-cooled engines.

More for Canal Defense

The President's request is for $185,440,000 in cash and $64,560,000 in contract powers, totaling $250,000,000—the balance of the $300,000,000 authorized. Panama Canal would get $21,062,500 in cash and permission to write $5,937,500 on the cuff, a total of $27,000,000.

Incidental Expenses Covered

Of course not all the $250,000,000 goes for airplanes. Expansion of the Air Corps will require additional personnel, more maintenance, more of everything. Nine millions will go for payrolls; for increased housing, $61,600,000; for aviation ordnance, $10,476,483. Thus only $131,700,655 would be spent for actual procurement of new airplanes and accessories—plus the $50,000,000 already appropriated. Bear in mind that much other aircraft procurement for Army, Navy, National Guard, Coast Guard, Marines is provided for in the regular program, and in carryover from previous years.

Continue Modernizing Equipment

The President has signed an omnibus appropriation bill providing cash and contract authority amounting to $153,000,000 for critical defense items for Army, seacoast, and fleet. Army will get $110,000,000 for tanks, anti-tank guns, semi-automatic rifles, gas masks, anti-aircraft guns, artillery, ammunition. Navy gets $36,000,000 for ship construction, and $6,539,287 goes for coast artillery at Panama and other stations. The bill contains many other non-military odds and ends.

To Expand Aeronautical Research

Five new aeronautic research laboratories will be asked by National Advisory Committee for Aeronautics, instead of the one previously sought at Sunnyvale, and rejected by Congress. Thumbs down on Sunnyvale was political skulduggery between Virginia and California delegations, not actually a rejection of N.A.C.A.'s request for more research. There is, nevertheless, an element of doubt on the Hill about the need, for Assistant Secretary of War Louis Johnson cannot resist bragging that he already is putting on the line the best and fastest military airplanes in the world. Of course, Lindbergh's inspection cruise was staged to promote N.A.C.A. aims, and it will be effective. Reinstatement of Sunnyvale, and a station near Chicago, would be the new starting program.

Raw Materials Plan Approved

Strategic raw materials bills have been passed by both houses; the House authorizing $100,000,000 and the Senate cutting it to $40,000,000; both would cover a four-year period. The bills have not yet gone to conference . . . The President signed the second deficiency bill, carrying $55,000,000 for ordnance, $36,000,000 to replace Naval vessels, omitting $6,378,000 for Sunnyvale air research plant . . . . Administration proposes to convert the Reconstruction Finance Corporation into a war finance commission if this country should go to war, in the hope of maintaining normal security markets . . . Army and Navy advise Roosevelt to consolidate hull, ordnance and propulsion bureaus under one ship construction head . . . Brookings Institution is making a study for the War Department of price and wage control in event of war . . . Roosevelt issued orders for establishment of a new Caribbean military division having status equal with Hawaii, Panama, Philippines, and the nine U. S. corps areas; base will be Puerto Rico, and it will be a Gibraltar for America's Panama life-line.

INSIDE DETROIT

By Rupert Le Grand
DETROIT EDITOR

Many tool and die shops pushed to capacity as more extensive changes are put through for next year's cars. Earlier introduction of new models likely.

DETROIT—As the tooling-up program for 1940 models unfolds, it becomes increasingly evident that: (1) More money is being spent on dies of all kinds than in years; (2) Bodies will be much more carefully streamlined; (3) Each car will be distinctive in design instead of following a so-called style trend.

Local tool and die shops, which had considerable business on hand a few weeks ago, have received much additional work. Fisher Body is reported farming out the majority of its program, because General Motors divisions have loaded it far beyond the capacity of its "captive" shops. Briggs also has extensive programs for Ford and Chrysler. All told, it looks as though body changes will cost more than at any time in the past five years.

Further evidence of the rapid step-up in die releases is contained in reports by suppliers of diemakers' necessities and by commercial heat-treaters. Die sets are being sold in the greatest volume in the history of one company. Heat-treaters report that the volume of tool and die work received from automotive sources for '40 production is double that of a few weeks ago.

Those who have followed the new designs through from the clay models assert that, besides the increase in streamlining, the interesting thing about the overall situation is that each line is distinctive. This is particularly true of the products of the Big Three. Other companies, with the exception of Hudson, are not expected to make extensive changes. So far as the low-priced lines are concerned, Chevrolet is said to have an exceptionally large program. Those who have seen the Chevrolet design for 1940 say the car differs radically from the current models.

Work Rushed on Tools and Dies

Practically all manufacturers are demanding that dies and tools be finished by June 30. Suppliers are skeptical that this date can be met. It is generally understood, however, that Ford will exhibit a radically changed body at the New York World's Fair about Aug. 1. Competitors are anxious to be in a position to show one or more new lines at the same time, if the sales outlook demands it.

As predicted, production began to taper off early in May, after running 55 per cent ahead of last year for the first four months. The market seems to have tired a little earlier this spring, and the stocks of used cars, particularly late-model trade-ins, are increasing. Optimism concerning the sales appeal of 1940 models is so ill concealed that it would not be surprising to see the industry jump the gun again on its New York show date, and to do it by a wider margin.

Factors in favor of such a course are: (1) Third and fourth quarter profits could be conceivably increased by advancing new model introducitons if the sales curve starts to nosedive in June; (2) Dealers would be pleased because they wanted either an early show or a year-end introduction, not the Oct. 15 date set for the New York show; (3) The automobile industry would not have to take a back seat at the New York and San Francisco fairs so far as new things are concerned, but could take immediate advantage of the interest created by the fairs in new products.

Winter Employment a Problem

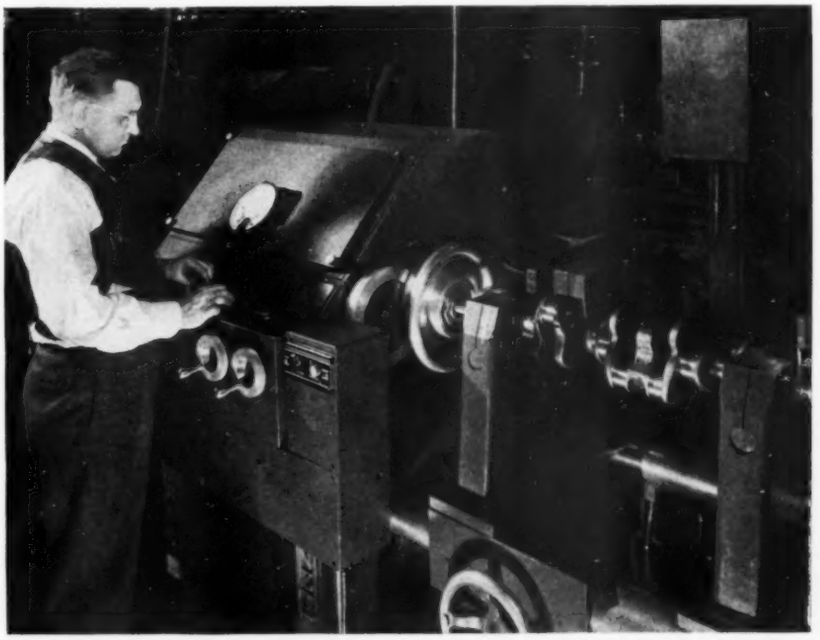
The main disadvantage of an early introduction appears to be the problem of maintaining steady operations and employment during the winter months. The industry has enjoyed remarkably steady operations since last fall, and the benefits are not enjoyed entirely by labor. Just now the sales departments are watching events with exceptional attention, and purchases for production are geared closely to their findings. A decision to wind up production on current models will depend on the outlook in the next six weeks, and at least several producers will be in a position to make that decision shortly.

Crosley Car a "Plus" Item

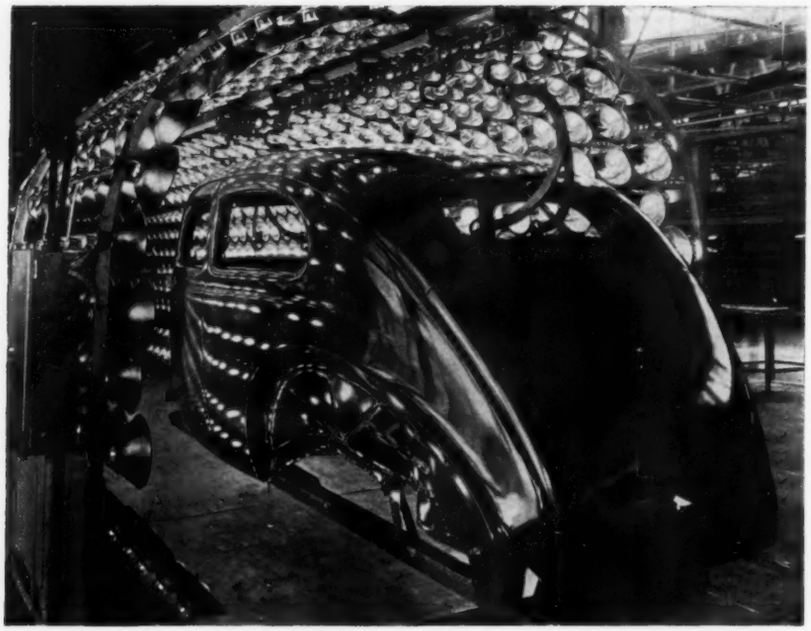
Detroit's curious will not see the 80-in. wheelbase, 15-hp. Crosley car

WAUKESHA BUILDS MIDGET MOTORS

CHICAGO—Production on an initial order for 5,000 engines for the small car introduced two weeks ago by Crosley Corp. begins this week at Waukesha Motor Co., Waukesha, Wis. Manufacture of this small two-cylinder opposed air-cooled engine is expected gradually to increase working hours from 36 to 40 per week for some 1,250 employees.



Faster Balancing—*Plymouth has just installed a Gisholt "Dynetric" balancing machine that gives four direct readings for depth of holes to be drilled at the Nos. 1, 2, 5 and 6 crank throws in order to give complete static and dynamic balance to the crankshaft. Floor-to-floor time averages 45 sec.*



Golden Glow—*Concentrated by 14,000 gold-plated reflectors, infra-red rays bake the paint on Ford and Mercury bodies "from inside out." Radiant energy penetrates the finish and heats the metal underneath, drying the paint in one quarter the time required with steam ovens. Reflectors are plated with gold since this metal reflects the rays with a minimum of loss. Each is fitted with a 240-watt carbon-filament bulb*

until about May 25, when samples are to be displayed by Republic Supply Corp., local Crosley distributor for radios and appliances. Deliveries in limited numbers will not begin locally until June 10-15. Republic reports that orders have been taken for 25 baby cars, sight unseen.

Selling agents are to be limited to Crosley radio and appliance dealers. There are 45-50 such outlets in Detroit, but it is still a question of how many of them will show the new product. The overall length is only 120 in. and the tread 40 in., but some dealers may be limited by showroom space or access to it.

The baby car represents a "plus" item for dealers in that overhead is already set up on the basis of the other lines. The largest expense in connection with selling the car is the salesman's commission. But the gross profit is much smaller than on radios, for example, so that the car is mainly interesting to the dealer as a source of a few dollars extra profit.

He is not to be burdened by the used-car situation, and probably not by rendering service. Powell Crosley has expressly stated that trade-ins will not be accepted. The margin on a car selling for $325 f.o.b. Richmond, Ind., would hardly allow trade-ins anyway.

Anticipated first-year production of 40,000 units does not constitute competition to the Big Three in the new-car field, and should make little difference to used-car merchants. Crosley has a nation-wide dealer organization of about 25,000 and is able for that reason to obtain less sectionalized distribution than the American Bantam. That car is sold most readily in the South, is priced about $75 higher f.o.b. Butler, Pa., less taxes, and is understood to have sold less than 4,000 units last year. Prospective customers for the Crosley are believed to be: (1) well-to-do people who want a runabout, (2) young people and children, (3) families that want a new second car but don't want to spend the money for a Big Three model or its upkeep, and (4) merchants wanting cheap delivery service.

The Crosley is strictly an assembled job. Initial sales in a country the size of the United States should be large enough to amortize development costs to a large extent and to pay off parts suppliers. Then if future sales volume does not support the undertaking, Mr. Crosley can get out with the satisfaction of knowing that he has not set up an expensive plant.

Automotive manufacturers are apparently not giving the Crosley any serious consideration. Comments range from, "Just another one of those things that pop up from time to time," to, "We have not given it any thought."

U. S. Government Contracts Awarded to Metal-Working Firms

(Awarded from April 17–29 inclusive)

Contractor	Gov't Agency	Commodity	Amount
National Tube Co., McKeesport, Pa.	Navy, S. & A.	Steel flasks	$59,580
Erie Forge Co., Erie, Pa.	Navy, S. & A.	Steel forgings	59,025
Edward G. Budd Mfg. Co., Philadelphia, Pa.	Navy, S. & A.	Doors, hatches	124,012
Steel Construction Co., Portland, Ore.	Interior	Revolving screens	22,862
Scovill Mfg. Co., Waterbury, Conn.	Treasury	Nickel blanks	50,750
American Magnesium Corp., Cleveland, Ohio	Navy, S. & A.	Magnesium	25,340
Fyr-Fyter Co., Dayton, Ohio	War, Air Corps	Fire extinguishers	37,044
King Machinery Tool Co., Cincinnati, Ohio	Navy, S. & A.	Boring machine	13,455
Brown & Sharpe Mfg. Co., Providence, R. I.	Navy, S. & A.	Milling machines	48,210
Carlton Machine Tool Co., Cincinnati, Ohio	Navy, S. & A.	Drilling machine	11,036
Acme Machinery Co., Cleveland, Ohio	Navy, S. & A.	Forging machine	11,497
Jones & Lamson Machine Co., Springfield, Vt.	Navy, S. & A.	Turret lathes	10,284
Worthington Pump & Machinery Corp., Harrison, N. J.	Navy, S. & A.	Pumps, air compressors	142,620
Caterpillar Tractor Co., Peoria, Ill.	Agriculture	Tractors, scrapers	32,418
United Aircraft Corp., Pratt & Whitney Aircraft Div., East Hartford, Conn.	Philadelphia Navy Yard	Parts and tools for aircraft engines	200,000
Wright Aeronautical Corp., Paterson, N. J.	Philadelphia Navy Yard	Engine parts	46,769
United Aircraft Corp., Hamilton Std. Propellers Div., East Hartford, Conn.	Navy, S. & A.	Propellers, governor units	89,746
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.	Navy, S. & A.	Base rings	89,545
U. S. Pipe & Foundry Co., Bessemer, Ala.	W. P. A., Treas., Proc.	Water pipe	68,097
Bethlehem Steel Co., Bethlehem, Pa.	Navy, S. & A.	Rails	31,160
American Brass Co., Waterbury, Conn.	Navy, S. & A.	Seamless tubing	33,134
International Harvester Co., Chicago, Ill.	C. C. C., Interior	Tractors	58,202
Continental Motors Corp., Detroit, Mich.	War, Ordnance	Air-cooled engines	35,642
American Broach & Machine Co., Ann Arbor, Mich.	War, Ordnance	Broaching machine	23,493
Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.	Navy, S. & A.	Machine tools	40,219
National Acme Co., Cleveland, Ohio	War, Ordnance	Spindle machine	14,983
Kingsbury Machine Tool Corp., Keene, N. H.	War, Ordnance	Machining unit	12,012
Pomona Pump Co., Pomona, Calif.	Interior	Pumping units	21,400
R. Hoe & Co., New York, N. Y.	War, Ordnance	Recoil mechanisms	110,981
Winchester Repeating Arms Co., Div. of Western Cartridge Co., New Haven, Conn.	War, Ordnance	Rifles	1,384,500
Douglas Aircraft Co., Santa Monica, Calif.	Navy	Airplanes, spare parts	1,547,463
Bendix Aviation Corp., Bendix Products Div., South Bend, Ind.	War, Air Corps	Wheel, brake assemblies	21,830
Kline Mfg. Co., Columbus, Ohio	War, Air Corps	Control assemblies	23,750
Consolidated Aircraft Corp., San Diego, Calif.	Navy	Airplane spare parts	28,130
Kollsman Instrument Co., Elmhurst, N. Y.	Navy, S. & A.	Generators	42,432

IMPORTANCE OF MODERNIZATION EMPHASIZED BY TELL BERNA

CLEVELAND—"Ten years of subnormal business in most metal-working plants has created a tremendous shortage in machine tools and mechanical equipment of all kinds," asserted Tell Berna, general manager National Machine Tool Builders Association, during a dinner of the Industrial Marketers of Cleveland. "Competent management realizes that this means excessive costs, resulting in high prices to the consumer and, in the last resolution, more unemployment.

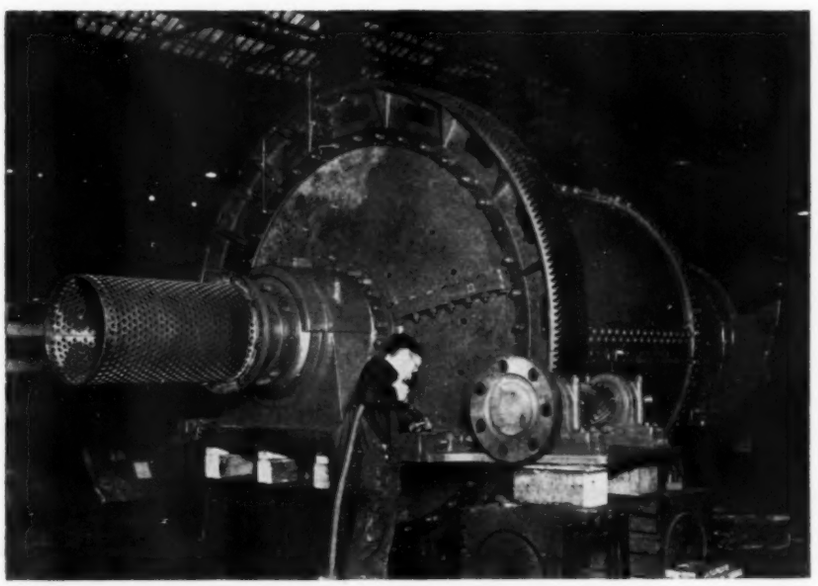
"New machine tools frequently pay for themselves in two years in the savings they make possible," Mr. Berna continued. "This is equivalent to 50 per cent interest on the money invested—a far greater return than can be secured by industrialists in any other investment field".

Although savings due to equipment modernization are often spectacular, many industrialists have been hesitant in replacing old machines with new during slack periods, when certain changes could be effected with the least interference with production. As a result, the percentage of obsolescence in the nation's industrial equipment has for some time been steadily increasing. Data presented by Mr. Berna showed that government arsenals and navy yards are using equipment of which 80 per cent is of World War vintage or older. "Even that is not so serious", Mr. Berna stated, "for our chief reliance in an emergency is the vast capacity of our *industrial* plant—obsolescence there is of critical importance."

All Holes Barred—*Holes smaller than a pinhole are detected in a yard-wide ribbon of thin sheet steel racing through this machine at speeds up to 1,000 ft. per min. Device utilizes a bank of phototubes to scan the sheet and makes a conspicuous mark by each hole. Designer F. H. Gulliksen, left, Westinghouse control engineer, states that it can be used on all sheet metals*

MACHINE TOOL INDEX DROPS

CLEVELAND—The index of machine tool orders fell to 155.6 for April, 1939, compared with 185.4 for March and 90.3 for April, 1938. The three months average rose 2 points to 169.4.



Designed for Flight—*Built by Allis-Chalmers for a gold mine in primitive Nicaragua, this huge grinding mill was designed in sections so it could be flown into the interior. Total weight is over 51,000 lb., but each part had to weigh less than 5,000 lb. and fit in a 3½x4½x14-ft. space*

MARCH MACHINE TOOL EXPORTS ESTABLISH NEW HIGH RECORD

WASHINGTON—Exports of machine tools reached the record value of $12,057,012 in March, an increase of 45 per cent over shipments for the corresponding months of 1938, according to figures revealed by the Machinery Division, Bureau of Foreign and Domestic Commerce. Continued large shipments to Russia, Japan and Great Britain, plus sharply increased shipments to France, were primarily responsible for the high level reached by this trade, since over 80 per cent of the March exports went to these four countries.

Total industrial machinery exports increased 17 per cent over the figures for March, 1938, ringing up a total of $29,564,195 for the month.

NAVY AWARDS UNDER WAY

WASHINGTON—Contracts totalling $2,694,161 have been awarded by the Navy Department in its first move to get its new airplane construction program under way.

United Aircraft Corp., East Hartford, Conn., received the largest contract, for airplanes and spare parts, amounting to $2,103,800. The company also received a contract for airplane engines totalling $570,694. Wright Aeronautical Corp., Paterson, N. J., was awarded a contract for aircraft engines amounting to $20,667.

WATCHING WASHINGTON

McGraw-Hill Washington Bureau

PAUL WOOTON, CHIEF

French begin following U. S. lead in educational orders program: commission is here to award sample tool contracts. Neutrality question still hangs fire.

WASHINGTON — Commands d'instruction means "educational orders" in French and it means business in any language. The objective of the French mission, here to place sample tool orders and to study American metallurgy, is similar to that of the War Department in its educational program of critical munitions purchases. The Frenchmen will spend from one to two months in this country, visiting metal-working plants in Massachusetts, Connecticut, Vermont, Pittsburgh, Chicago and other machinery centers, and they will be in Washington one or two days before they go home. The mission is headed by Maj. Gen. Andre Govard, French Army Inspector General of Ordnance. Their official home while in the U. S. is the French Embassy in Washington, where Colonel Emmanuel Lombard, military attache, seems to be responsible for them. Colonel Lombard says that they are primarily interested in the possibility of purchasing certain types of machine tools in this country, although they are also looking at iron and steel, and particularly American brass work.

Beryllium Battle

A strange tale of international patents intrigue between citizens of the United States, Germany, and England was revealed last week when the Anti-monopoly committee (TNEC) began its study of alloys, starting with testimony on beryllium. The general intention was to show how a new industry with attractive possibilities must run the legal rat maze. Patents involved hardening of products more than the processing of the parent metal. The competitive future of beryllium products with alloys such as phosphor bronze is amazingly complicated, and may be very important. Interested persons will do well to ask the Committee for a record of the hearings. As for the strange tale, it boils down to this: Germans held the patents; Americans and Germans made a deal dividing the Western Hemisphere and Europe respectively, leaving England in the middle; England, by threatening confiscation of German foreign patents, muscled in. Although opinion is divided over the importance of beryllium as a war material, Germany is understood to be the only nation using an alloy of this metal, beryllium-nickel, in high-speed aircraft engine parts. This strongest of beryllium alloys will shortly be produced commercially by the Beryllium Corp. of Pennsylvania's plant at Reading, Pa.

Still Debate Neutrality

No one whose opinion is worth much is predicting what Congress will do about neutrality. Section 2 of the law has expired. That section authorized the President to write a list of war supplies and permit their sale to belligerents only on a cash basis, for delivery on other than American ships. Section 1 is still in effect. It prohibits the export of arms and implements of war on any basis whatever to warring countries. So, at present, we cannot sell munitions to nations at war, but we can sell them plenty of materials to make munitions. Congress seems to have the choice of three proposals: (1) Repeal the neutrality law and go back to international law; (2) Enact the Pittman plan, which would enable France and England to buy arms from us on a cash-and-carry basis; (3) Enact the Thomas plan, which would empower the President to forbid sale of arms to "aggressors" whom he would name.

LOOK TO CONGRESS

Any tax tinkering with a view to encouraging business will have to result from a drive inside Congress, without any encouragement from the White House. John Hanes still has his list of one hundred changes which could be made in the tax law and which would help business. Secretary Morgenthau privately agrees with him. But the President slapped down an inspired story, which had obviously been given to the Associated Press by the Treasury, as "mere estimates" gotten up as a result of requests for information from Capitol Hill!

Roosevelt is sticking by his stated formula—that Congress can make any changes in business taxes it may think advisable *providing* the amount of *estimated* taxes to be raised from business is not decreased. The joker is in that word *estimated.* Mr. Roosevelt simply will not consider the idea that a reduction in tax estimates might produce a net increase in revenue by encouraging business.

Wagner Act Jitters

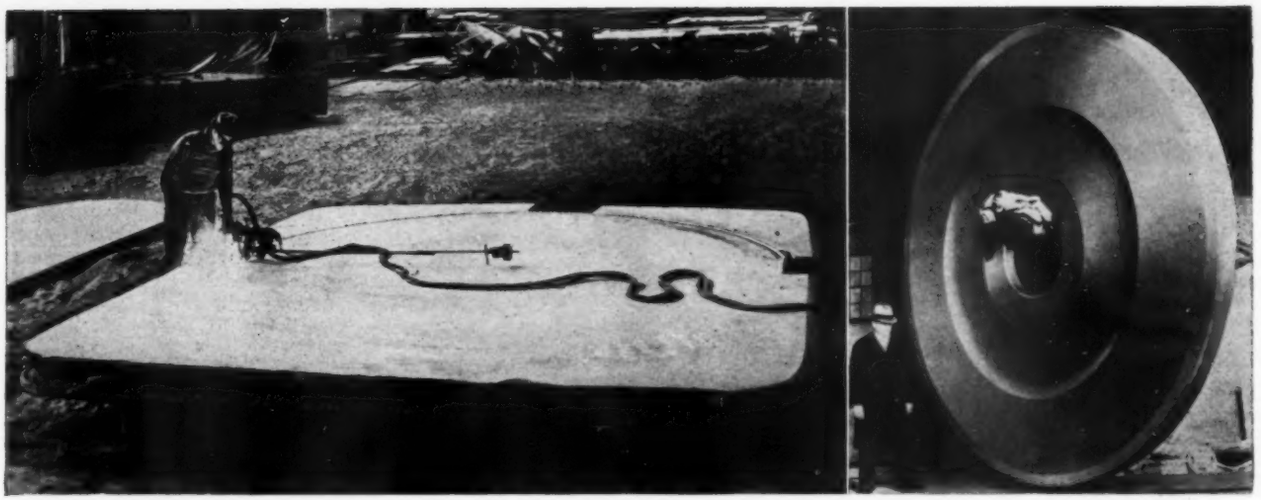
Uncertainty beclouds the move in Congress to amend the Wagner act. Conservatives who want to see it cut to pieces or repealed are trying to prevent any minor amendments which would quiet the uproar and defeat their purpose. Administration leaders, on the other hand, are trying to put through some small changes with the express intention of closing the issue for the session. Major changes probably will not be made, but hearings will go on, with a steady flow of testimony damaging to the law. The issue will come up again next session, if decisive action is not taken this year. The Administration fears that if its enemies succeed in emasculating the Wagner Act they will follow up with attacks on other New Deal reforms.

Chamber of Commerce Group Stymied

The United States Chamber of Commerce convention's resolutions fell like a heavy frost upon the Administration's conciliatory inclinations, if any, and as a result there will be less rather than more appeasement from No. 1600 Pennsylvania Avenue. It remains to be seen whether remaining legislation this session will be affected. Neutral observers say the 2,000 business men were premature in their assumption that the Roosevelt deal has weakened enough to be jumped on.

Speed for the Navy

Navy has called for bids on hulls and fittings for torpedo boats and submarine chasers, to be opened at 10:00 a.m. May 25. The schedule covers four 59-ft. wooden motor torpedo boats; two 81-ft. wooden motor torpedo boats; two 110-ft. submarine chasers; one 170-ft. sub chaser. Copies of the schedule have been sent to about 230 boat- and ship-building companies. Bids should go to the Bureau of Supplies and Accounts, Navy Department. . . . Two 45,000-ton battleships, for which Navy is completing plans, are reported as being designed for 35 knots, as against usual battleship speeds around 25 knots. The ships will carry twelve 16-in. guns and will be built on rush order in Navy yards.



Flame-Cut Flywheel— *From a rolled plate 200 in. long, 170 in. wide and over 9 in. thick, the By-Products Steel Corp., Coatesville, Pa., flame-cut two disks used in making flywheels by the Mesta Machine Co. of Pittsburgh. Each rough machined plate, right, is 164¼ in. in diameter, 8 3/16 in. thick and weighs 49,850 lb.*

INDUSTRIAL ADVERTISERS TO MEET

NEW YORK—A national conference intended to benefit every branch of industry and organized by the National Industrial Advertisers Association, will be held at the Hotel New Yorker, New York, N. Y., Sept. 20-22 under the sponsorship of the Technical Publicity Association of New York and the Industrial Marketers of New Jersey.

Executives and advertising men representing many American and Canadian industries are expected to attend to learn recently developed methods for improving sales and sales promotion work. Throughout the conference, stress will be laid on industrial marketing. Even the projected tour of the New York World's Fair will be undertaken as a study in modern methods of displaying and dramatizing industrial products.

The formal program will include general sessions and eleven clinics.

Exports of Machinery During March 1939

	March 1939	February 1939	March 1938
Electrical machinery	$9,329,934	$6,719,583	$10,017,653
Power generating machinery except automotive and electric	2,099,629	876,963	1,497,312
Construction and conveying machinery	1,827,541	1,765/537	2,669,622
Mining, well and pumping machinery	6,259,655	4,985,230	6,147,255
Power driven metal-working machinery	12,057,012	7,832,893	8,297,396
Other metal-working machinery	344,327	307,018	656,671
Textile machinery	831,194	557,178	799,945

Exports of Metal-Working Machinery During March, 1939

Engine lathes	662,379	607,586	510,655
Turret lathes	468,017	552,591	614,461
Other lathes	219,137	122,856	62,392
Vertical boring mills and chucking machines	713,161	290,461	309,249
Thread cutting and automatic screw machines	313,067	337,331	279,855
Knee and column type milling machines	840,717	427,722	543,627
Other milling machines	1,584,536	1,168,583	528,237
Gear-cutting machines	486,165	283,964	229,185
Vertical drilling machines	134,914	95,259	132,997
Radial drilling machines	114,067	63,775	233,003
Other drilling machines	407,601	113,570	80,022
Planers and shapers	379,707	254,959	215,393
Surface grinding machines	364,562	218,805	132,782
External cylindrical grinding machines	380,154	304,243	410,700
Internal grinding machines	380,803	180,510	393,320
Tool grinding, cutter grinding, and universal grinding machines	270,747	145,435	265,651
Other metal-grinding machines and parts	611,258	576,646	277,890
Sheet and plate metal-working machines and parts	374,495	427,637	602,748
Forging machinery and parts	615,961	506,933	231,784
Rolling mill machinery and parts	1,619,110	675,551	1,302,494
Foundry and molding equipment and parts	96,831	47,820	130,988
Other power-driven metal-working machinery and parts	1,019,623	530,656	709,963

Other Metal-Working Machinery

Pneumatic portable tools	101,790	81,084	333,285
Portable and hand and foot operated metal-working machines and parts	92,867	86,817	150,237
Chucks for machine tools	27,426	17,548	24,133
Milling cutters, machinery operated thread dies and taps and similar machinery operated metal cutting tools	67,412	74,376	78,213
Other metal-working machine tools	54,832	47,193	70,803

EUROPEAN TENSION RESULTS IN LARGER JAPANESE TOOL DEMAND

TOKYO—More rather than less machine tool business is to be expected from Japan, since many munitions plants here are looking to the United States to supply their immediate requirements as European plants have been thrown out of gear by the Czechoslovakian crisis. In addition to production tools for immediate installation, Japan will require a large number of primary machine tools to boost its own machine tool output by 100 per cent, as envisaged in a three-year plan that has been announced by the Cabinet Planning Board.

Although a new German-Japanese trade agreement of greatly enlarged scope is expected shortly, importers here are frankly doubtful whether Germany will be in a position to step up machine tool sales in Japan. Delivery terms of German manufacturers have already been drawn out to eighteen months, with two months to be added for transit. Since the second Czechoslovakian crisis German deliveries have been tending to become still more tardy. Many orders have been canceled.

American supremacy has unquestionably asserted itself in the field of aircraft engineering, both in fuselage and engine construction. Germany is supplying some unfabricated light metal shapes, but little machinery for aircraft manufacture and fewer complete ships.

Six of the largest American aircraft manufacturers are closely cooperating with Japanese interests, with consulting engineers engaged to organize production on the patterns evolved in their home plants. This means that Japanese aircraft manufacturers are going to use the same machine tool set-ups as employed in prominent U. S. aircraft plants.

B. D. KUNKLE

E. R. BREECH

C. E. WILSON

PERSONALS

CHARLES E. WILSON, vice-president General Motors Corp., has been elected executive vice-president, with headquarters in Detroit. B. D. KUNKLE and E. R. BREECH have been elected vice-presidents and members of the administration committee, while GRAEME K. HOWARD has been named a vice-president. WILLIAM S. KNUDSEN, president, has been designated as chairman of the administration committee, and Mr. Wilson as vice-chairman.

CHARLES B. COOK, vice-president Royal Typewriter Co., and BENJAMIN F. CONNOR, vice-president Colt's Patent Fire Arms Mfg. Co., Hartford, Conn., have been elected directors of the Colt's organization.

HENRY J. MOKATE has been appointed manager of the merchant products bureau, sheet division, Carnegie-Illinois Steel Corp., Pittsburgh, Pa. CHARLES SCHRAMM has been named manager of the secondary products division succeeding Mr. Mokate.

A. C. STREAMER, former manager of the switchgear division, Westinghouse Electric & Mfg. Co., has been appointed general manager of the East Pittsburgh division.

Mr. Streamer came to the East Pittsburgh works in 1907 after graduation from Colorado State University. Upon completing the apprentice engineering course, he was assigned to the switchboard engineering department. In 1931 he was made manager of the diversified products department and continued in executive positions that led to his appointment as manager of the switchgear division when it was formed.

F. R. KOHNSTAMM, manager of the Westinghouse lighting division and agency sales department, Cleveland, Ohio, has been appointed sales manager of the merchandising division at Mansfield, Ohio. He succeeds R. E. IMHOFF, resigned.

A. C. DANEKIND, assistant vice-president General Electric Co. and president of the National Machine Tool Congress, has been elected a director of the Carboloy Co., Detroit, Mich.

HOWARD M. GIVENS, JR., former assistant manager of sales, stainless bar and wire products division, Allegheny-Ludlum Steel Corp., Pittsburgh, Pa., has been named assistant general manager of tool steel sales. He is succeeded by J. R. KUMER, former Pittsburgh district sales manager, whose duties in turn will be assumed by R. S. AHLBRANDT.

BURDON B. P. HYDE has been elected a vice-president of the Scovill Mfg. Co., Waterbury, Conn.

MARVIN W. SMITH, manager of engineering Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., has been elected a vice-president.

Mr. Smith, who will direct all the company's engineering activities, has been associated with Westinghouse since 1915, when he enrolled in the company's student engineering course. Two years later he was assigned to the power engineering department as a design engineer. He became section engineer in 1927, division engineer in 1930, and manager of engineering in 1936.

L. E. OSBORNE has been appointed manager of manufacturing and engineering, merchandising division, Westinghouse Electric & Mfg. Co., Mansfield, Ohio.

MELVIN PATTISON, recently resigned as president and treasurer, Industrial Brownhoist Corp., Bay City, Mich., has been elected chairman of the board. His former duties will be assumed by HOYT E. HAYES, vice-president. JAMES B. HAYDEN, former assistant sales manager, will serve as sales manager.

LEIGHTON W. ROGERS, former president Aeronautical Chamber of Commerce of America, has been elected a vice-president of Bellanca Aircraft Corp.

I. A. ROSE has been appointed factory works manager, Edison General Electric Appliance Co., Chicago, Ill., maker of "Hotpoint" home appliances.

GEORGE J. STANLEY and I. W. WILSON, vice-presidents Aluminum Co. of America, Pittsburgh, Pa., have been elected directors.

FOSTER E. WORTLEY, manager of the Cleveland district sales office, American Rolling Mill Co., Middletown, Ohio, has been appointed assistant manager of the Mid-Western sales area, with headquarters in the company's home offices. HENRY L. WOODS, JR., for the past ten years connected with the company's Detroit office, has been appointed manager of the Cleveland office to succeed Mr. Wortley.

R. B. MILDON, vice-president Westinghouse Electric & Mfg. Co., formerly in charge of the East Pittsburgh division, has moved to the Pittsburgh headquarters of the company to assume special sales assignments. Mr. Mildon came to Pittsburgh in April, 1938, from Philadelphia, where he had been in charge of the South Philadelphia steam and stoker division of the company. He has been associated with Westinghouse since 1906, and has been a vice-president since 1934.

A. C. STREAMER

M. W. SMITH

R. B. MILDON

P. C. NICHOLSON

C. C. ZIEGLER

S. M. CROCKER

PAUL C. NICHOLSON, treasurer Nicholson File Co., Providence, R. I., has been appointed president and general manager, succeeding his father, the late COL. SAMUEL MOWRY NICHOLSON.

After his graduation from Yale in 1911, Mr. Nicholson went to work for the Nicholson File Co. and has been continuously identified with the organization up to the present time. In 1913 he was elected vice-president, and two years later was named treasurer, which offices he has held until his recent election as president and general manager.

C. C. ZIEGLER, formerly Western district sales manager Greenfield Tap & Die Corp., Greenfield, Mass., has been appointed vice-president in charge of sales, with headquarters at the company's home office. He succeeds W. B. DUMONT, resigned.

Other changes in Greenfield Tap & Die personnel have also been made. ELMER C. BRYANT, former manager of the gage department, has been appointed Western district sales manager, with headquarters at Chicago. EDWARD C. BAILEY, former sales promotion manager, has been appointed Eastern district sales manager, with headquarters in New York City. GLEN STIMSON, former chief engineer at the Detroit plant, has been appointed gage sales manager, with headquarters in Greenfield.

G. M. STICKELL, former assistant sales manager Landis Machine Co., Waynesboro, Pa., has been appointed sales manager.

JOHN STORM has been appointed district sales manager of the Carborundum Co., Niagara Falls, N. Y., with headquarters in New York City. Mr. Storm succeeds FRANK J. HARRINGTON, who has been transferred to the company's sales department at Niagara Falls.

CHESTER C. TODDING, formerly connected wiith the DeSoto division of Chrysler Corp., has been apointed assistant general manager of Willys-Overland Motors, Inc., Toledo,, Ohio.

STUART M. CROCKER has been named manager of the air-conditioning department of the General Electric Co., with headquarters in Bloomfield, N. J. He will have charge of all commercial refrigeration activities of the company, some of which, previously located in Cleveland as part of the appliance and merchandise department, have been transferred to Bloomfield.

BUSINESS ITEMS

Allis-Chalmers Mfg. Co., Milwaukee, Wis., has awarded contracts for a $378,000 addition to its plant in Pittsburgh, Pa. Expected to be ready for occupancy August 1, the new plant will be equipped with some of the most modern facilities in the country for the production of large transformers.

A branch factory for the manufacture of airplane landing gear and other parts for commercial aircraft, as well as rock drills and pneumatic tools will be erected for the **Cleveland Pneumatic Co.,** in Burbank, Calif. The completed plant will consist of three buildings representing an investment of $250,000.

Beryllium Corp. of Pennsylvania, Reading, Pa., has completed the installation of facilities for the commercial production of heat-treated beryllium alloys in rod, strip and wire forms. Hitherto the company has supplied only master alloys in ingot and cast form.

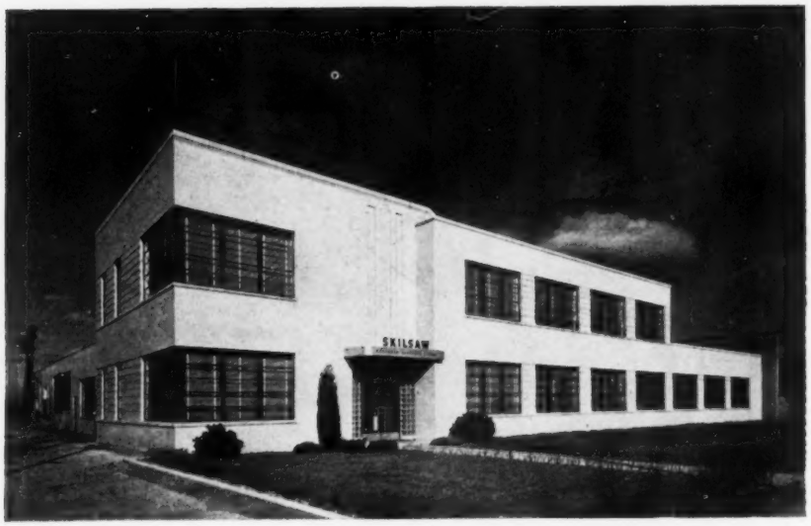
Chrysler Motors of California, Los Angeles, California, has begun an extensive modernization program for its Los Angeles plant. Improvements will include the installation of new rust-proofing and finishing equipment, new materials handling equipment, rearrangement and modernization of the passenger car and truck assembly lines, two large additions to the plant and new electrical equipment to handle the increased power requirements. The new enameling department will provide up-to-date rust-proofing and spraying equipment and will be completely air-conditioned. In the new sheet metal finishing department will be installed the latest wiring machines, welders, punch presses, metal finishers and conveyors.

Douglas Aircraft Co., Santa Monica, Calif., is planning an addition to its aircraft assembly plant containing approximately 60,000 sq. ft. of floor space.

Harvill Aircraft Die Casting Corp. has been organized in Los Angeles, Calif. with a capital stock of $500,000. Directors are: LEO B. WARD, J. R. VAUGHN, MARCUS L. ROBERTS, M. L. KOELTERS, and A. H. RISSE, all of Los Angeles.

Link-Belt Co., Chicago, Ill., has contracted for the construction of a new office and warehouse building in Dallas, Tex. Structure will measure 105x225 ft. and will be equipped with a number of machine tools for processing such stock parts as may require additional machine work to fit them for specific requirements.

"Open House"—*Employees and their families were shown through the new No. 1 plant of the Norton Co., Worcester, Mass., on May 13 as part of the company's "open house" program held during the weekend. Also inspected were the new cafeteria, new Nos. 2 and 3 plants and the No. 4 plant*



Still Growing—*Although Skilsaw, Inc., has only recently moved into its new plant in Chicago, above, a 70 per cent increase in business during the first quarter of 1939 has made necessary an addition to the structure, designed and built by the Austin Co., Cleveland*

Meehanite Metal Corp., Pittsburgh, Pa., has established a subsidiary company known as the South African Meehanite Metal Co., Ltd., Johannesburg, South Africa. This step was taken due to the increased industrial activity in South Africa which is being accompanied by considerable expansion among iron and steel producers and by mining operators.

Northrop Aircraft, Inc., Los Angeles, Calif., is planning to build an aircraft factory on a 20-acre site adjoining the municipal airport in Long Beach, Calif. The first unit of the plant will have over 100,000 sq. ft. of floor space and will cost approximately $500,000.

Ohio Gear Co., Cleveland, Ohio, has appointed the Kansas City Rubber & Belting Co., Kansas City, Mo., as its sales representative in the Kansas City area.

Philadelphia Gear Works, Philadelphia, Pa., has opened a branch office in Chicago, under the supervision of A. R. HERBERT.

Scovill Mfg. Co., Waterbury, Conn., has purchased the Waterbury plant of the International Silver Co., which has been idle for several years.

Trundle Engineering Co., Cleveland, Ohio, has opened an eastern office in New York City under the direction of HAMILTON B. BOLE, former president of the Barst Forster Dixfield Co.

United Aircraft Mfg. Corp., East Hartford, Conn., is planning construction of a factory at Meriden, Conn., which will employ approximately 150 men for the production of aircraft parts.

Westcott Chuck Co., Oneida, N. Y., has appointed the R. R. Vought Co., San Francisco, Calif., as its West Coast representative.

Wickwire Spencer Steel Co. has placed in operation a new $500,000 mill for the manufacture of steel wire in Buffalo, N. Y. Heretofore, the Buffalo plant's output has consisted mainly of ingots, billets and wire rods. Many operations of the corporation's Massachusetts plants are being shifted to Buffalo to be carried on in the new mill, and it is expected to require from six months to a year before operations will be brought to capacity.

OBITUARIES

JACKSON DAVIS ALLEN, 52, cold finished products sales manager, Jones & Laughlin Steel Corp., Pittsburgh, Pa., died May 9.

GEORGE D. COLBORN, 49, founder and president Century Metalcraft Corp., Chicago, Ill., died recently.

JOHN J. GIBSON, 66, retired vice-president of the Westinghouse Electric Supply Co., died May 6 at his home in Philadelphia after an illness of several weeks.

WILLIAM H. JACKSON, for the past seventeen years president Pittsburgh-Des Moines Steel Co., died April 26 in a Pittsburgh hospital. He was 71 years old.

FRANK MATTHIESSEN, 67, vice-president and a director of the Columbia Tool Steel Co. and of the Gisholt Machine Tool Co. until his retirement in 1929, died May 4 in a Chicago hospital.

GEORGE C. MILLER, 61, since 1923 president of the Dodge Mfg. Corp., Mishawaka, Ind., died May 10 of heart trouble. He had also been general manager of Montgomery Ward, president of Tillotson Mfg., and vice-president of George W. Goethals Co.

WARREN W. PALMER, for many years designer for Chicago machinery companies, died April 26 in that city. He was 81 years of age.

CHESTER HERBERT PLANT, president Plant's Machinery, Ltd., Montreal, Que., died recently. He was 57 years old.

JULIUS A. ROESCH, JR., president Steel Sales Corp., Chicago, Ill., died of a heart attack in Pittsburgh, Pa., April 27. He was 58 years of age.

ADRIAN BOYD SLOAN, secretary-treasurer Cushman Chuck Co., Hartford, Conn., died April 30. He was 57 years of age.

OSCAR STEINKEMPER, 51, president Oxygen Equipment Co., Chicago, Ill., died April 25 in Peoria, Ill.

LAWRENCE M. VILES, 56, chairman Buda Co., Harvey, Ill., railway supplies manufacturer, died April 26 in Chicago.

MEETINGS

AMERICAN ELECTRO-PLATERS' SOCIETY. International convention, Asbury Park, N. J., June 19–22. W. J. R. KENNEDY, executive secretary, 90 Maynard St., Springfield, Mass.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Combined Summer and Pacific Coast convention, San Francisco, Calif., June 26–30. H. H. HENLINE, secretary, 33 W. 39th St., New York, N. Y.

AMERICAN IRON AND STEEL INSTITUTE. General meeting, Hotel Waldorf-Astoria, New York, N. Y., May 25. Executive secretary, WALTER S. TOWER, 350 Fifth Ave., New York, N. Y.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Semi-annual meeting, San Francisco, Calif., July 10–14.

AMERICAN SOCIETY FOR TESTING MATERIALS. Annual meeting and exhibit of apparatus and instruments, Chalfonte-Haddon Hall, Atlantic City, N. J., June 26–30. R. E. HESS, assistant secretary, 260 S. Broad St., Philadelphia, Pa.

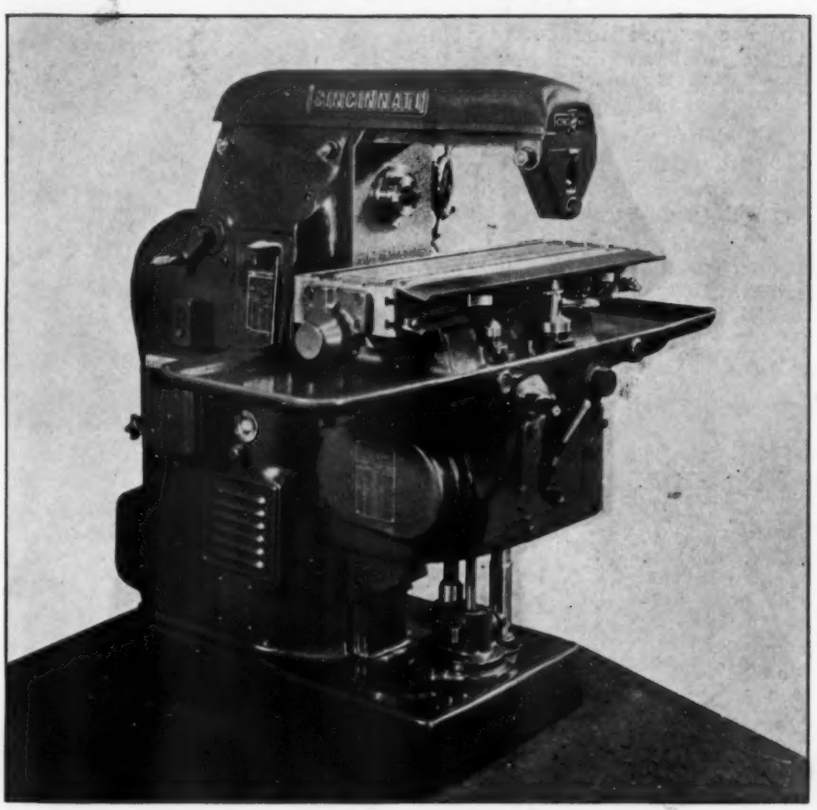
ASSOCIATED MACHINE TOOL DEALERS OF AMERICA. Spring convention, Van Curler Hotel, Schenectady, N. Y., June 5 and 6. THOMAS A. FERNLEY, JR., executive secretary, 505 Arch St., Philadelphia, Pa.

NATIONAL METAL TRADES ASSOCIATION. Annual convention, Palmer House, Chicago, Ill., May 24–25. O. R. ABBOTT, office manager, 122 S. Michigan Ave., Chicago, Ill.

SOCIETY OF AUTOMOTIVE ENGINEERS. World automotive engineering congress, Hotel Pennsylvania, New York, N. Y., May 22–28; Hotel Statler, Detroit, Mich., May 31–June 8; Hotel Fairmont, San Francisco, Calif., June 6–8.

SHOP EQUIPMENT NEWS

Backlash Eliminator Featured In New Automatic Millers



The No. 1-12 and No. 1-18 plain automatic milling machines introduced by the Cincinnati Milling Machine & Cincinnati Grinders, Inc., Cincinnati, Ohio, are particularly suited for rapid milling of small parts. These machines are of the manufacturing type and combine high spindle speeds with fast feeds. The No. 1-12 machine has a power table travel of 12 in., while a travel of 18 in., is provided by the No. 1-18 miller.

Sixteen spindle speeds, obtained through pick-off gears and a back gear, range from 50–1,500 r.p.m. An alternate range of 40–1,500 r.p.m. can be supplied. The pick-off gears are located in a protected compartment in the left side of the machine column and are easily accessible for changing spindle speeds. Rotation of the spindle may be started or stopped by a control lever located on the left of the column.

A range of sixteen table feeds from $\frac{3}{4}$ to 30 in. per min. is standard. A high series ranging from $1\frac{1}{2}$ to 60 and a low range of from $\frac{1}{2}$ to $21\frac{1}{2}$ in. per min. can be supplied. All feed changes are obtained by pick-off spur gears located in a compartment on the left side of the knee. There is a complete automatic dog-controlled working cycle for the table which includes a 30 in. per min. power rapid traverse. It is possible to obtain a dog-controlled intermittent feed and rapid traverse in any combination or in any direction.

For climb milling operations, a hydraulic backlash eliminator is provided. This unit consists of a nut on the table feed screw moved axially by hydraulic pressure, but prevented from rotating on the screw by keys extending from an adjacent bushing. Operating in conjunction with the conventional fixed nut, the backlash nut pulls the lead screw always in the direction of the feed. The entire backlash unit is hydraulically neutralized during rapid traverse movements of the table. A vertical hand adjustment of 8 in. for the knee is provided.

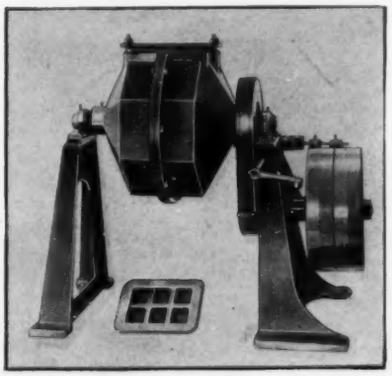
500-Ton Presses Have High Speed

Three 500-ton single-acting "Hyspeed" hydraulic presses have been built by Baldwin-Southwark Corp., Philadelphia, Pa., for the production stamping of automobile parts. These presses are capable of making 22 short working strokes a minute. An adjustable stripper is provided in the moving down platen. Platen area measures 48 x 41 in. Full working stroke of each press is 20 in. The press can be operated manually, semi-automatically or automatically. Each press is self-contained, the pump,

motor and valves being located on the top of the press. Side housings are of cast steel.

Small Cutting Barrel Has Triple-Action

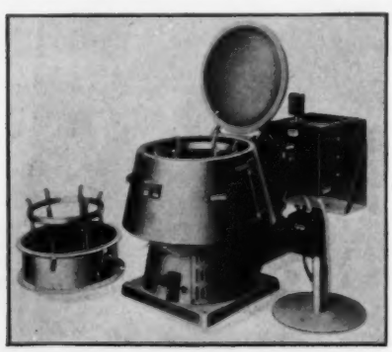
Available either with direct-connected motor drive, or arranged for belt drive as shown, this 4 cu. ft. capacity tumbling barrel announced by the Hartford Steel Ball Co., Hartford, Conn., is designed so that a triple action is produced in tumbling the material. This multiple action quickly grinds off burrs and smooths



the surface of any article in the load. It can be used for mixing, tumbling, pulverizing, dry grinding, wet grinding, cutting down and similar tumbling operations. The unit is 46 in. high, 29 in. wide and 58 in. long when arranged for belt drive. This unit weighs 1,000 lb.

Tolhurst Galvanizer Made in Three Sizes

A more even finish for hot tinned and galvanized articles is claimed for the centrifugal galvanizer offered in three sizes by the Tolhurst Centrifugal Division, American Machine & Metals, Inc., 100 Sixth Ave., New York, N. Y. The machine consists essentially of a removable basket and retaining cage, which is mounted

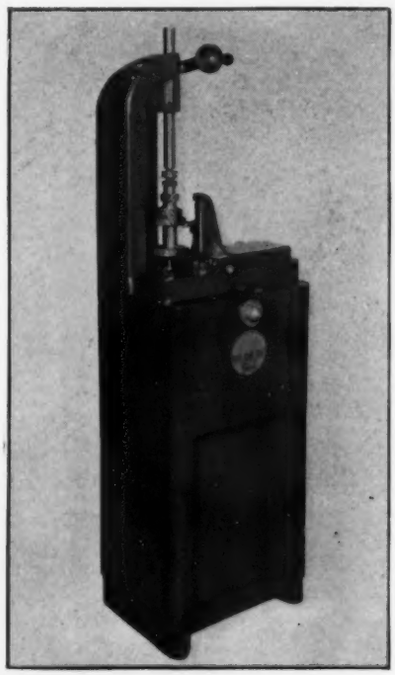


within the casing. The basket, also used as a container for the work, is carried through the hot metal bath in the usual manner and then placed in the centrifugal galvanizer and rotated. The centrifugal force throws off the excess spelter, leaving an even layer of metal. Thickness of the coating is controlled by the acceleration of the machine and the final speed attained. The largest machine is capable of handling articles up to 24 in. long and has a rated load capacity of 100 lb.

No. 6M Involute Measuring Machine Employs a Master Profile Cam

Using a master involute cam in the place of base rolls, tapes or sine bars, the No. 6M involute measuring machine developed for checking involute profiles by the Fellows Gear Shaper Co., Springfield, Vt., will check gears up to 6-in. pitch diameter. The indicator pointer holder has a movement of 3½ in.

The position of the main slide is set with standard sized blocks and automatically locates the involute pointer at the correct base circle radius for any gear within the



The involute profile on gears up to 6 in. pitch diameter is checked rapidly in the No. 6M involute measuring machine

capacity of the machine. Another block sets the involute pointer on the so-called starting position. A graduated dial employed in connection with the dial indicator provides for checking tooth modifications. It is possible to check both sides of the tooth without removing the gear from the center. Gears of

Cluster gears can be checked at one setting of the work in this machine, as the work spindle can be elevated and the tail center is adjustable

small diameter can be checked as accurately as gears of larger size.

This machine operates on the principle that all involutes developed from the same base circle radius are the same, and that the only way in which the shape of the involute can be changed is to change the base radius. The master involute cam is developed from a base circle radius greater than the maximum capacity of the machine. It is only a matter of changing the radial distance of the pointer relative to the axis of the gear when checking smaller base radii. Rate of travel of the slide carrying the indicator then is changed automatically to agree with the base radius setting.

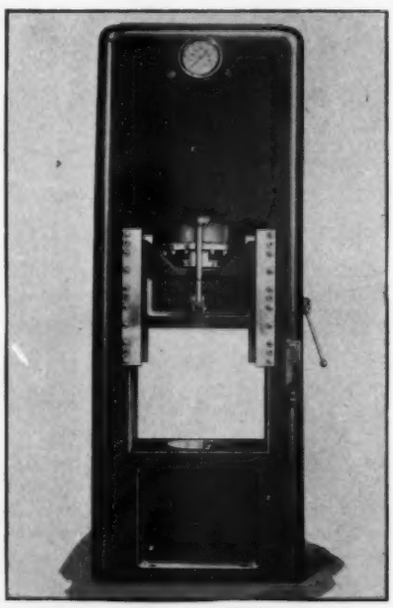
"Erco" Riveter Punches Rivet Holes

Within the capacity of the machine, all types of solid and tubular rivets, including countersunk rivets, can be handled with equal facility in the Model 279 "Erco" automatic punching and riveting machine developed by the Engineering and Research

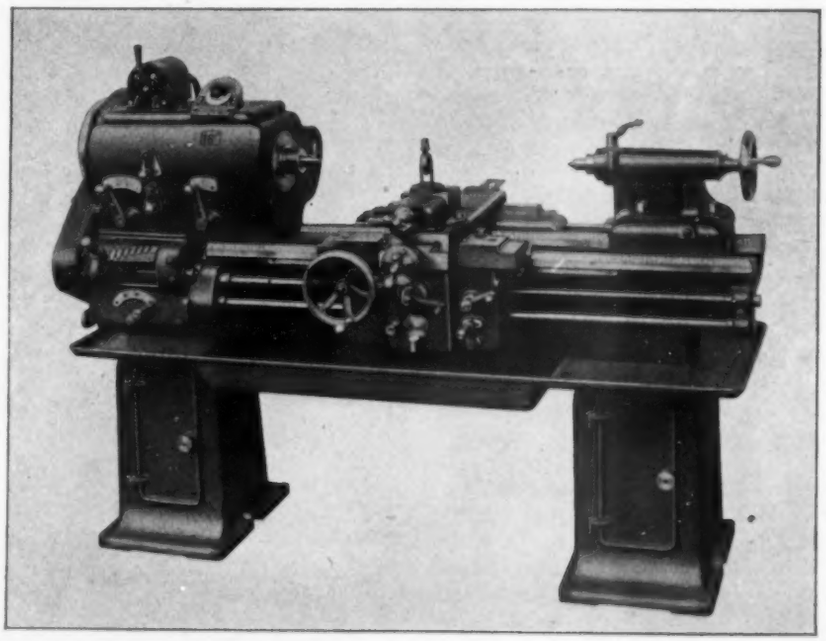
Corp., Riverdale, Md. This machine has a C-type frame and a 36-in. depth of throat. The hole is punched through two or more layers of material after they are assembled in position, then the punch is forced out of the hole as the rivet is put down onto the punch. This machine will punch holes up to $\frac{5}{32}$ in. in diameter through $\frac{5}{32}$ in. thickness of all layers of material not exceeding 65,000 lb. per sq. in. tensile strength. The machine will feed rivets up to $\frac{1}{2}$ in. long and requires an air pressure of 90–100 lb. per sq. in. for operation of the head. Net weight is 2,450 lb.

"Oil-Power" Press Has High Speed

The French Oil Mill machinery Co., Piqua, Ohio, is offering a line of self-contained hydraulically operated "oil-power" hydraulic presses for metal forming and stamping operations. These units are built with capacities ranging from 150 to 1500 tons and can be furnished with different sizes of beds as required. The hydraulic pump, all operating valves, and all pipe and fittings are mounted within the head of the press, which also serves as the reservoir for the hydraulic system. Operation of the press is by means of pushbuttons, although a single hand lever is provided for controlling the operation and speed of the ram when setting up dies. By means of this lever, the ram may be moved in either direction at any required speed or held stationary at any intermediate point. The press shown will close at a speed of about 600 in. per min., has a pressing speed of 30 in. per min. and an opening speed of about 500 in. per min. The hydraulic system is designed for 2,000 lb. per sq.in. working pressure, and this unit is powered with a 40 hp. motor. Adjustments on this press include: (1) automatic maximum adjustment of pressure at which the press will automatically reverse, this can be adjusted from 75 to 300 tons, (2) automatic maximum adjustment of pressure should it be desired to hold pressure on the press for an appreciable period of time, (3) adjustment of closing speed from 50 to 600 in. per min., and (4) adjustment of the up position of the slide so that the press may be operated through any part of its maximum stroke. This press has a 30 x 36 in. bed area.



"Super Regal" Lathes Offered in Four Sizes

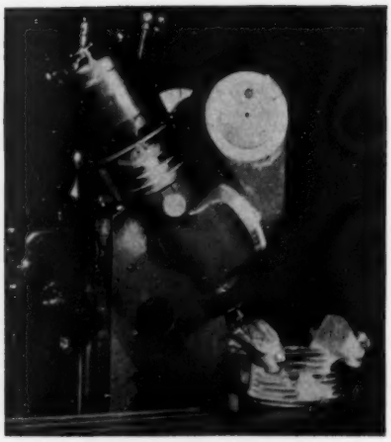


Offered in 13, 15, 17 and 19 in. sizes, the "Super Regal" line of lathes announced by R. K. LeBlond Machine Tool Co., Cincinnati, Ohio, incorporate a speed selector built into the headstock. This selector shows the cutting speed for commonly machined materials, indicates the necessary spindle speed for the proper cutting speed and shows the lever setting necessary to deliver the indicated speed. These lathes are of heavy construction throughout. The ways have been reinforced to resist high torque and twisting strain.

The selective geared headstock provides eight spindle speeds, the final drive being through helical gears. Conflicting gear ratios cannot be engaged at the same time. A feed rod is provided so that the lead screw is used only for screw cutting, insuring accuracy of the screw for the life of the lathe. Cabinet legs provide space for storing tools. Specifications: swing over ways, $13\frac{1}{4}$ in. on the 13-in. lathe to $19\frac{1}{4}$ in. on the 19-in. lathe; swing over carriage and taper attachment, $8\frac{1}{4}$ in. on the 13-in. lathe, $10\frac{1}{2}$ in. on the intermediate sizes and 12 in. on the 19 in. lathe.

F-M Milling Head Is Fully Universal

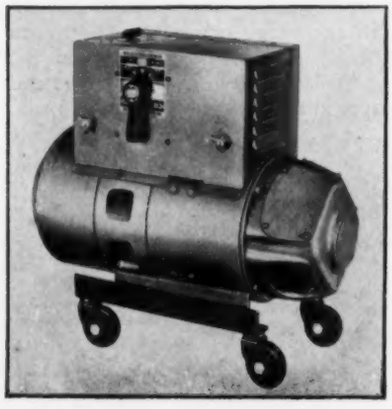
The "All Angle" full universal high speed milling head developed by Gray-Mershon, Inc., 515 W. Windsor Road, Glendale, Calif., can be



used for milling, drilling, reaming, grinding, boring, spot facing, and similar operations at any angle. When not in use, the attachment can be swung up out of the way where it will not interfere with regular milling operations. The basic unit is entirely self-contained. Type A attachment does not have spindle travel or depth stop, while the Type B unit has a spindle travel of 4 in. with depth stop. Standard speed ranges of both types, without back gear, are 600, 1,200, 2,400 and 4,800 r.p.m. With the back gear units, the speed range is 175, 300, and 575 r.p.m. on back gear and 600, 1,200 and 2,400 r.p.m. on open belt.

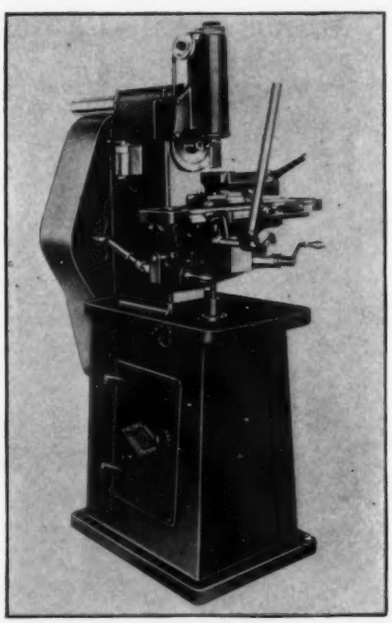
D. C. Arc Welder Has Close Adjustment

Wilson Welder & Metals Co., Inc., 60 E. 42nd St., New York, N. Y., is offering a d.c. arc welding motor generator set with a rating of 150 amp. at 25 volts. This welder has a range of adjustments from 20 to 200 amp. at 25 volts and an open circuit voltage of from 40 to 75 volts. The set will use electrodes up to $\frac{3}{16}$ in. diameter and standard wiring is for 3 phase, 220 or 440 volt, 60 cycle power supply. Current control on this welder consists of a three-point current switch, and a dial rheostat control for fine adjustments. Welding qualities claimed for this set are a steady arc and quick voltage recovery; it welds without current surges and without losing the arc when welding on thin sections.



Improved Hand Miller Has Motor in Base

Power feed can be provided on the improved motor-in-base hand miller offered by Miller & Crowningshield, Greenfield, Mass. Motor is mounted on an adjustable plate and can be removed through a hole cast in the base. It has a four speed V-belt pulley connected to a jackshaft to give an 80-730 r.p.m. range of spindle speeds. The vertical attachment offered for use with this machine is

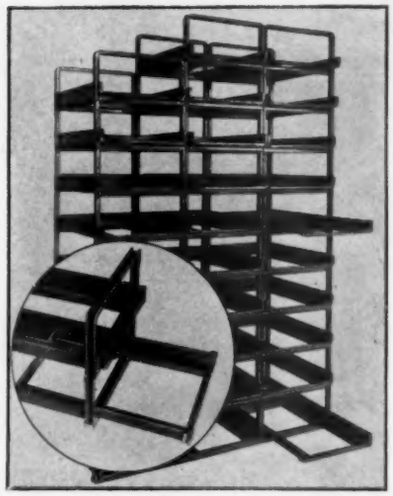


equipped with ball bearings on the spindle and idler pulley.

Specifications: Table feed, 14½ in.; cross feed, 3¼ in. with micrometer dial; vertical adjustment of knee, 9 in. with micrometer dial; size of table, 6½ x 22 in.; over-all height of machine, 54 in.; size of motor, ½ or ¾ hp.; net weight, 650 lb.

"Stackracks" Have Roller Slides

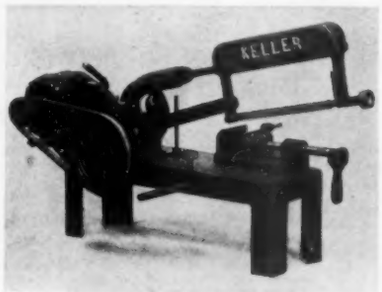
Made from interlocking units of channel and formed steel, which are set up to form box storage racks of any height, size or capacity, "Stackracks" offered by Stackbin Corp., 42 Troy St., Providence, R. I., have been improved by the addition of a roller bearing slide which is claimed to make the handling of heavy boxes easy and safe. Roller bearings fit into



the channel steel of the slide in such a way that the sliding motion of the box is restricted to one-half of its length, enough to permit ready access to the contents of the box.

"Keller" Hacksaw Provides Two Speeds

Designed so that it can be moved to the job, the "Keller" portable power hacksaw announced by Sales Service & Mfg. Co., 3401 Forty-fifth Ave. S., Minneapolis, Minn., is available as a bench model, as shown, or with floor legs and stock rest. The bench model can be mounted on a truck for use by maintenance men. The saw has capacity to cut stock measuring 4 x 4 in. and is equipped with a vise which swivels to 45 deg. Speeds



of 70 and 125 strokes per min. are available and the stroke is 4 in. Drive is from a ¼ hp. 110-volt a.c. motor. The bench model weighs 125 lb., and is 35 in. long and 12 in. wide.

Elmes Hydraulic Press Provides High Speeds

A high speed hydraulic drawing and forming press incorporating sensitive and accurate control features has been announced by the Charles F. Elmes Engineering Works, Morgan & Ful-

STANDARDIZED TAPER ARBORS . . . THEIR SAVINGS AND ADVANTAGES TO MILLING MACHINE OWNERS

BEFORE the adoption of the National Standardized Taper Nose Arbors by milling machine manufacturers, about twelve years ago, it was necessary for milling machine owners to carry a range of sizes of individual arbors suited to the various makes of milling machines in the plant. Arbors were not interchangeable at that time and a heavy investment in different makes of arbors was required.

Today the milling machine owner need only have various sizes — K & T Standardized Taper Arbors can be used on all makes of milling machines, utilizing the taper nose arbor. Arbors in a wide range of sizes are immediately available from K & T to meet all normal requirements.

UNVARYING standards of accuracy are maintained in K & T Arbors by constant testing with the finest of master gauges. There is a difference in arbors and the difference in K & T Arbors is shown in the superior performance of your milling machines. Write for copy of new arbor catalog.

KEARNEY & TRECKER CORPORATION
MILWAUKEE, WISCONSIN, U.S.A.

"PROFIT MORE WITH K&T PRODUCTS"

FOR THE BEST MILLING MACHINE PERFORMANCE . . .
USE THE BEST ARBORS

MORE THAN 41 years OF DOING ONE THING WELL

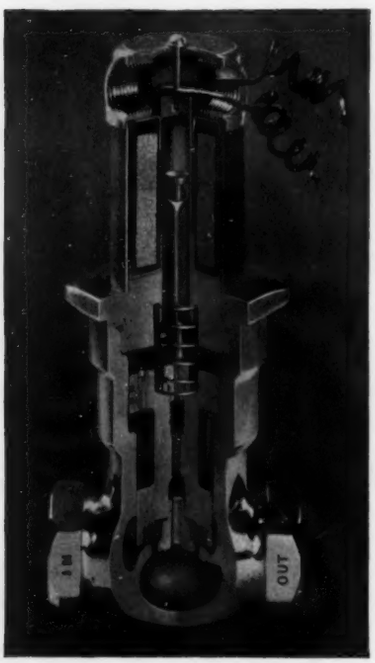
K&T

Milwaukee MILLING MACHINES

ton St. Chicago, Ill. The moving platen is guided on four adjustable gibs. The platen can be lowered a fraction of an inch at a time to facilitate the setting of dies. Platen stroke is adjustable so that the idle stroke can be brought to a minimum. Bed of this press is arranged for a cushioned cylinder. The top head serves as an oil reservoir, as well as the base for mounting the pump, motor and controls.

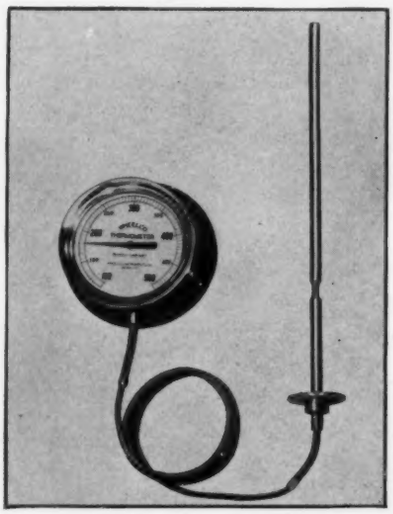
"Atkomatic" Valve Is Electrically Operated

Said to be particularly adaptable for operations where accuracy of operation is required, such as automatic control of elevators and lifts, automatic timing devices and accurate temperature controls, the "Atkomatic" electrically-operated valve announced by E. C. Atkins & Co., 424 S. Illinois St., Indianapolis, Ind., is available to provide full flow from $\frac{3}{8}$ in. to 3 in. pipe sizes on pressures up to 300 lb. per sq. in. Maximum steam pressure is 150 lb. per sq. in. The timing feature provides a variable closing speed to suit individual requirements, giving flexibility to operation.



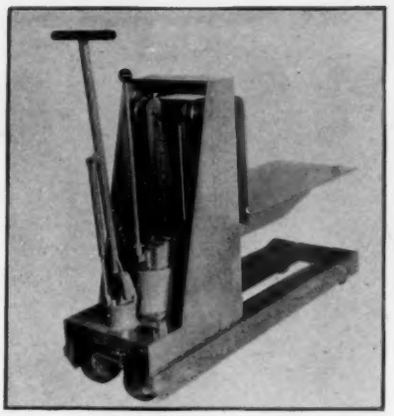
Dial Thermometer Made in Two Styles

Available in mercury, gas-filled or vapor actuation, the dial-indicating thermometer offered by Wheelco Instruments Co., 1929–1933 S. Halsted St., Chicago, Ill., is of simple design and construction. Made either as a stem type or as a long-distance type, as shown, these thermometers have a 6 in. dial face. Change of temperature at the bulb causes an expansion or contraction of the gas or liquid fill within the system. This actuates the Bourdon tube and moves the pointer across the face of the dial.



Cantilever Truck Has Elevating Table

Developed especially for maintaining skid loads of materials or parts at convenient heights for machine operators or assemblers, this cantilever-type truck announced by Lyon Iron Works, Greene, N. Y., has a hydraulic elevating table. In addition to the fifth wheel steer type shown, these trucks may be furnished with castered steer and with or without brake. The elevation is through hydraulic rams powered by a hand-operated single or two-speed hydraulic pump. They also may be furnished with a motor-driven pump.



Standard sizes of this type range in capacity from 350 to 5,000 lb. Platform widths range from 18 to 36 in. and lengths range from 24 to 60 in.

"Stubby" Lift Truck Is Only 38 In. Wide

Capable of lifting the bottom of a load to a height of 60 in., the "Stubby" lift truck offered by Clark Tructractor Div., Clark Equipment Co., Battle Creek, Mich., is 38 in. wide and has a 38-in. wheel base. The steering mechanism enables the truck

to pivot on one wheel and to make right angle turns. The hydraulic, telescopic lift mechanism derives its power from an engine-driven pump. Truck will lift any load having as little as 2 in. under-clearance and will carry it at speeds ranging from 1 to 7 m.p.h. It is powered with a gasoline engine.

Plier-Parallels Offered by Knu-Vise

Originally developed to take the place of square blocks and parallel clamps used for precision work on drill presses, surface grinders and the inspection bench, the No. 500 plier parallels announced by Knu-Vise

BOLT THREADING? . . . HERE'S THE MACHINE FOR YOUR WORK

Salvaging rusted bolts in large railway shop

The "RAPIDUCTION" Bolt Threader is designed and engineered from the base up to give you the best performance possible on a wide variety of work.

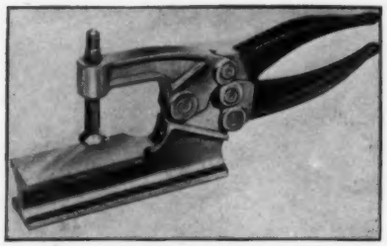
Built in two sizes, 3/8" to 1 1/2" and 1/2" to 2 1/4", in both single and double spindle models, the "RAPIDUCTION" handles not only standard jobs but, because vise and carriage are free from obstructions, is adaptable to the application of special fixtures for holding unusual jobs of many kinds.

Write today for complete information and specifications.

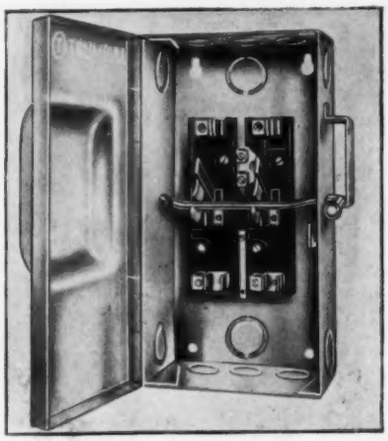
THE OSTER MANUFACTURING COMPANY

Sales Office: 2049 East 61st Street, Cleveland, Ohio
Factories: Erie, Penna., and Cleveland, Ohio
New York City Office, 30 Church St.
Philadelphia Showroom and Office, 111 No. 3rd St.
Threading Headquarters Since 1893

OSTER
THREADING EQUIPMENT
WILLIAMS



Products Co., Inc., 6430 Cass Ave., Detroit, Mich., are said to be accurate within 0.0005 in. These tools can be furnished with the lower member in a soft condition, thus permitting holes to be drilled so that the unit can be incorporated in the design of jigs and fixtures as a self-contained clamping unit.



Type D Switch Has 60-Amp. Capacity

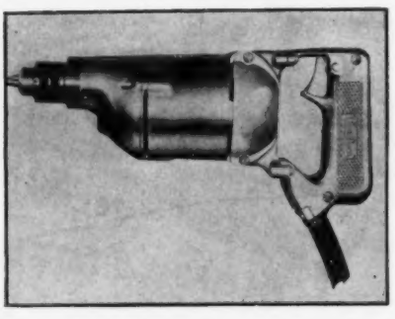
Individual poles in the improved 60-amp. side-operated Type D switch offered by the Trumbull Electric Mfg. Co., Plainville, Conn., are mounted on heavy porcelain and equipped with wire clamps. The case is finished in baked aluminum.

Drafting Machine Is "Free Floating"

The "Excello" free-floating drafting machine announced by the Eugene Dietzgen Co., 2425 Sheffield Ave., Chicago, Ill., is claimed to minimize drafting fatigue. The free-floating feature is obtained by the use of lightweight alloys, roller bearings, and precision construction, together with a method of gravity control that does not place a drag on the motions of the drafting machine under any conditions. The protractor head places the control of angles directly under the thumb. All moving parts are inclosed. It is suitable for drawings measuring up to 36 x 60 in.

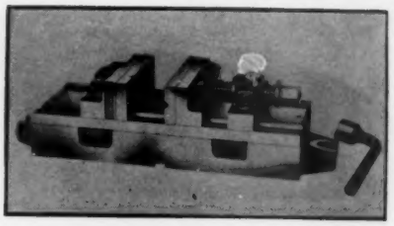
"Wrap Rax" Tape Insulates Racks

A synthetic thermoplastic resin in tape form, listed as "Wrap Rax," is offered by Hanson-Van Winkle-Munning Co., Matawan, N. J., for use as a coating for electro-plating racks. This coating is said to withstand the abrasion and mechanical and thermal shocks encountered in ordinary use without cracking or breaking and it will resist all of the cleaning, pickling and plating solutions commonly used. Its good dielectric properties provides good insulation. The tape now is available in 1 lb. rolls of $\frac{3}{4}$-in. widths.



"Utility" Drill Has 5/16-In. Capacity

The $\frac{5}{16}$-in. capacity "Utility" ball bearing electric drill offered by the Van Dorn Electric Tool Co., Towson, Md., has a no-load speed of 1,100 r.p.m. A deep-groove ball-bearing on the chuck spindle, with inner and outer races locked in place, absorbs thrust in all directions. This drill has chuck capacity for using $\frac{5}{8}$ in. diameter drills in hard wood.

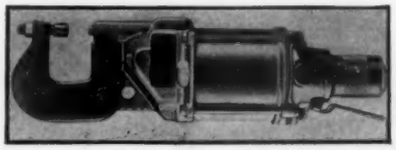


Heavy-Duty Vise Is Fully Adjustable

The front and rear jaws and the nut block of the 6-in. heavy-duty machine vise developed by the Producto Machine Co., 990 Housatonic Ave., Bridgeport, Conn., are adjustable to any position on the working surface of the hardened and ground base. The wearing plates are serrated to receive shoes attached to the bolts which lock the rear jaw and nut block in any desired position. Specifications: width of jaws, 6 in.; depth of jaws, $2\frac{1}{4}$ in.; maximum opening of jaws, 8 in.; overall length of vise, $18\frac{1}{2}$ in.; net weight, 75 lb.

"Thor" Rivet Squeezer Has Pressure Regulator

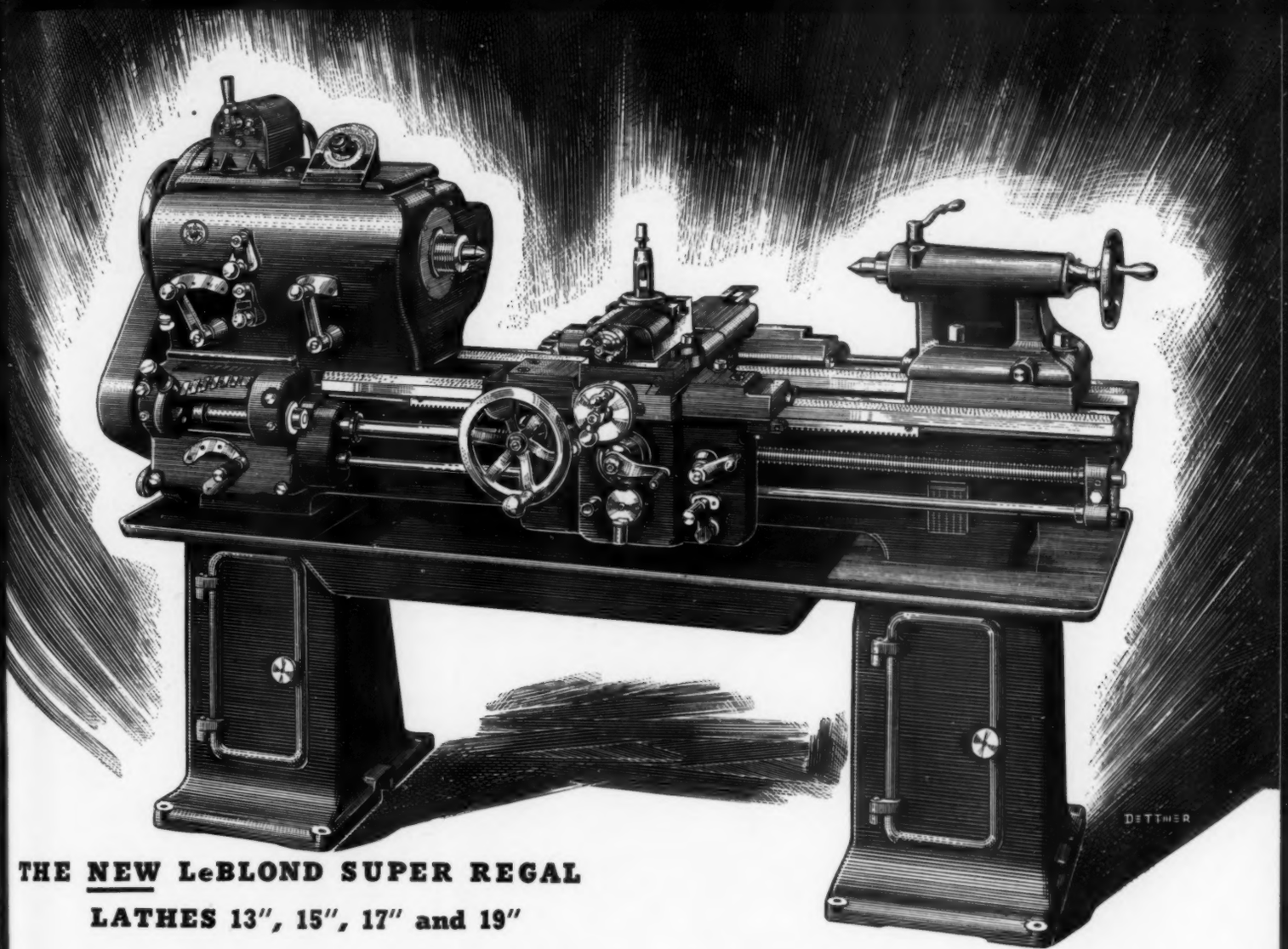
The "Thor" rivet squeezer announced by the Independent Pneumatic Tool Co., 600 W. Jackson Blvd., Chicago, Ill., is designed for use with $\frac{5}{32}$ in. steel and $\frac{3}{16}$ in. diameter dural and aluminum rivets. It is 12 in. long and weighs $7\frac{1}{2}$ lb.



It is claimed that this riveter is particularly applicable for operations where yokes, plungers and cuppings must be changed frequently. These changes can be made without disassembly of the tool. A pressure regulator permits the operator to set the pressure so that it is possible to drive both short and long rivets without changing the yoke or plunger. A stroke regulator can be adjusted quickly for different strokes to facilitate speed in riveting.

"Neotron" Weld Timer Controls Welding Cycle

Offered for use with spot, butt and projection welding machines, the "Neotron" weld timer developed by the Electric Controller & Mfg. Co., 2700 E. 79th St., Cleveland, Ohio, automatically controls the length of



THE NEW LeBLOND SUPER REGAL

LATHES 13", 15", 17" and 19"

No. 5 of a series of pen portraits presenting the tools that serve production progress.

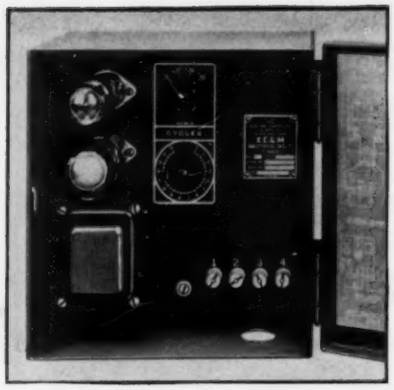
New — redesigned — vastly improved — heavier construction throughout — increased swing — sturdier bed with exceptionally heavy ways. Furnished with either plain or anti-friction bearings . . . Speed selector now built into headstock with dial to show cutting speed for commonly machined materials— to indicate R. P. M. for proper cutting speed—to show lever settings to deliver indicated speed . . . These new features plus Regal's well known safety, accuracy, simplicity and performance, will be welcome news to Regal enthusiasts.

LeBLOND LATHES HELP MAINTAIN STATE CAPITOL

An interesting installation recently made is the LeBlond 12", 16-spindle speed Regal in the State Capitol Building at Sacramento, California. This precision lathe is used for all types of turning and machining jobs—required in the maintenance of this beautiful structure.

For detailed data on the new Super Regals Address Dept. H-21

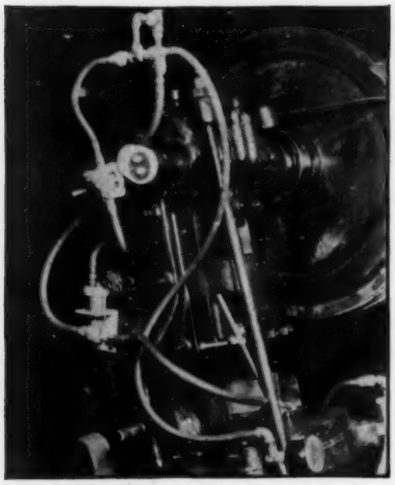
LeBLOND
CINCINNATI, OHIO
U.S.A.



time the current is allowed to flow through the pieces being welded. This timer operates on the principle of the time required to charge a condenser to a predetermined voltage. When this voltage is reached, the condenser discharges through a Neon tube to open the magnetic contactor incorporated in the main power circuit of the welding machine. When used on 60-cycle current, this timer gives a selection of time varying from ½ to 60 cycles and is adjusted by operating the two small dials on the front of the panel.

Schrader Pilot Valve Developed for Presses

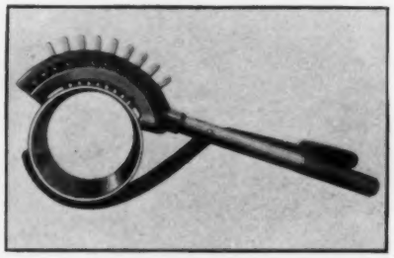
An improved pilot valve, offered by A. Schraeder's Son, Div. Scoville Mfg. Co., Inc., 470 Vanderbilt Ave., Brooklyn, N. Y., is designed to give a delayed or prolonged blast of air for ejecting work from a press after



the ram has stopped its upward motion. It is said to be especially useful on manually fed presses using overhead knockout or compound dies. Duration of the air blast may be regulated by screw adjustment on the valve. With vent closed, this valve may be used as an air control valve on any mechanism.

Safety Stamp Holder Is of Friction Type

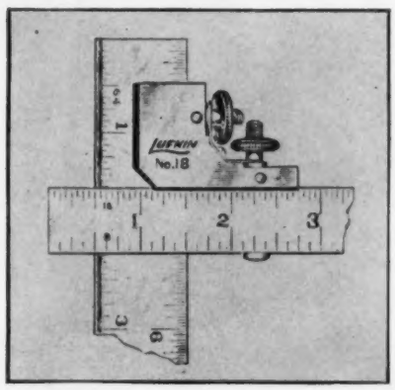
Large tubes, axles and other round materials can be marked either hot or cold with the safety steel stamp holder shown. Holding mechanisms of this unit, offered by M. E. Cunningham Co., 160 E. Carson St., Pittsburgh, Pa., is of the friction type eliminating the need for expen-



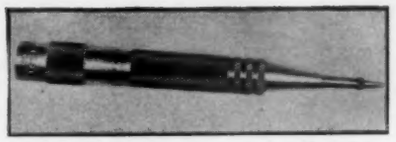
sive slotted stamps. Since one stamp can be pushed out while another is being inserted, changes can be made quickly. The holder is available in sizes and shapes for holding almost any number of stamps, depending upon the diameter of the material to be marked and the size of the character.

Improved Tools Offered by Lufkin

Improved hold down, rule clamps and automatic center punches are among the precision machinists' tools announced by the Lufkin Rule Co., Saginaw, Mich. The hold downs are designed to clamp the work securely and force it downward against the machine table. Both contact edges are tapered and there is a clearance step along the entire length of the front of the under side of each hold down. They are of steel, hardened and ground, and are made in 2, 3, 4, 5, and 6 in. lengths.



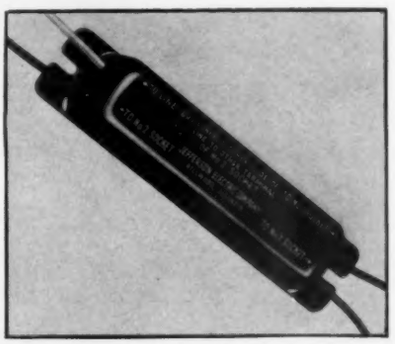
The No. 18-A rule clamp offered by Lufkin has a clip which prevents interference between the clamp bolts and nuts



Force of the blow of this No. 1671A automatic center punch is adjustable for different materials

The No. 18A rule clamp will hold at right angles a combination square blade of 12, 18 or 24 in. lengths and any regular steel rule not over 1 in. wide. This clamp also can be applied to thin steel squares. A clip with prongs at each end serves to hold both clamp nuts in place, thus eliminating interference between the two bolts and nuts on this tool.

When the No. 1671A automatic center punch is held upright on the work and downward pressure is applied, the tool will strike a blow automatically. The force of the blow can be regulated by turning the knurled cap. When set for medium stroke, the length of this punch is 5 in. Point is easily removed for grinding and replacement.



Unit Auxiliaries For Fluorescent Lamps

Of compact design, the auxiliary transformer unit shown is offered by the Jefferson Electric Co., Bellwood, Ill., for use with fluorescent lamps. These auxiliaries are compact in design and are small enough for concealed installation in strips, channels and lamp fixtures. The coils inside the metal case are machine wound and treated to remove and prevent absorption of moisture.

New Stop-Off Lacquer Is Non-Pigmented

The Michigan Chrome Co., 6340 E. Jefferson Ave., Detroit, Mich., has added a clear, non-pigmented lacquer to its line of "Supreme" stop-off lacquers. This coating material was developed especially for use in insu-

lating plating racks where the plater prefers a non-pigmented type of lacquer. It can be applied directly on a metal surface with no treatment necessary, other than a thorough cleaning of the surface to be coated. It is claimed to be practically unaffected through the regular cycle of decorative plating.

Roxalin Announces Crank Case Sealer

A crank case sealer which will stand immersion in lubricating oils for 4 hr. at 350 F. and which is claimed to be unaffected by Freon, Carrene and other refrigerants has been made available by the Roxalin Flexible Lacquer Co., Elizabeth, N. J. It is claimed that this material does not chip or flake under sharp knocks and severe abrasion, air dries in regular lacquer time and is applied easily by spraying or slushing. It is colored red to insure comp'ete coverage, but contains no abrasive pigments.

Improved Bar Back Offered by Pollard

The Pollard Bros. Mfg. Co., 5503 Northwest Highway, Chicago, Ill., have announced that the redesigned bar stock rack has been arranged so that the extension arms are bolted to the upright channels, and that these arms can be placed 3-in. apart. Seven arms are supplied with each rack and these arms can be placed in any position desired.

Adjustable Stand Holds Carbide Drums

Arranged to hold carbide drums when refilling acetylene generator reservoirs, the "Ideal" drum stand offered by Kilburn's Machine Shop, Spring Valley, Minn., is self-locking in the upright position and is easily adjusted to various heights of carbide drums. Using this stand with most generators, it is possible to pour the carbide directly from the drum to the generator reservoir quickly.

"Puridex" Cleaner Removes Solid Dirt

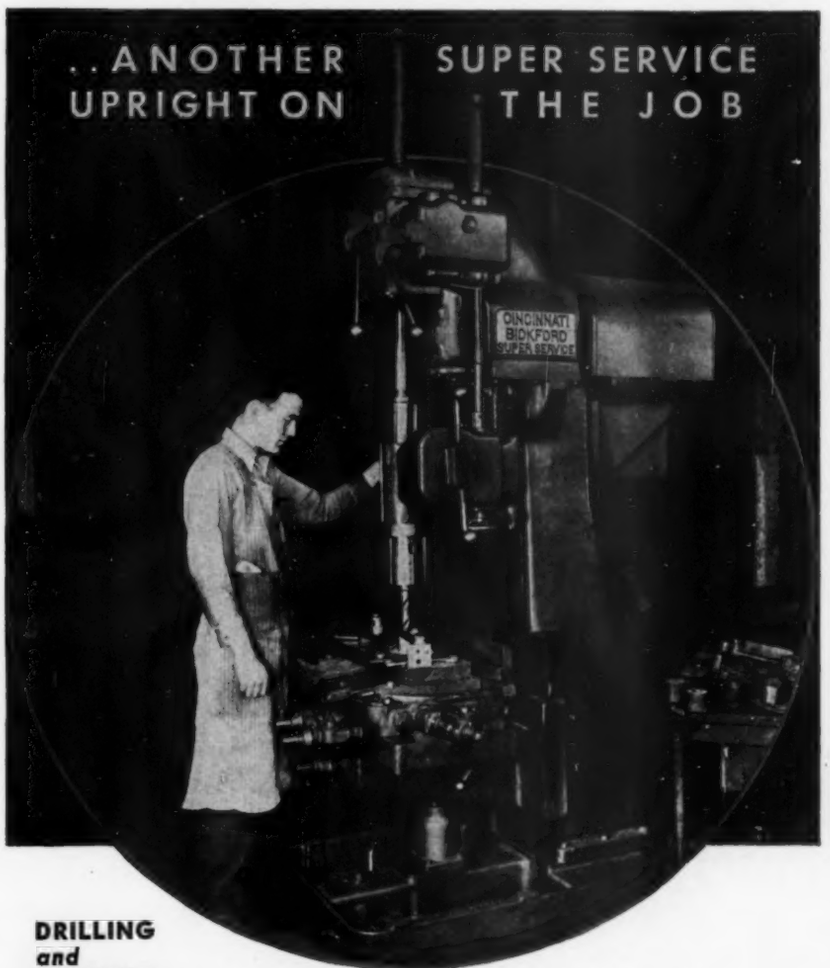
The Puritan Mfg. Co., Waterbury, Conn., offers the "Puridex" alkaline cleaner for electrolytic cleaning of metals from which carbon smut and similar solid dirt must be removed. This cleaner is used with reverse current, using the work as an anode, and the high conductivity of the cleaner permits relatively high current densities with conventional voltages.

"Super-Flex" V-Belt Uses Improved Cords

The Dayton Rubber Mfg. Co., Dayton, Ohio, has announced that the "Super-Flex" V-belt now is made up with "Daytex" cord in the neutral axis. This cord is claimed to have improved tensile strength, low stretch, and due to interlocked fibers, minimum tendency to become lifeless. In the process of manufacturing this cord, a bonding-compacting agent removes the non-essential oils and waxes from the outside of the individual fibers, causing the fibers to interlock and form a stronger, yet more compact cord.

"Ipco" Fog-gle Cloth Cleans Goggle Lenses

Impregnated with a non-toxic wetting out agent which reduces surface tension on the glass, "Ipoc" Fog-gle



DRILLING *and* REAMING ARE EASILY, ACCURATELY HANDLED

The Pneumatic Scale Corporation, Norfolk Downs, Mass., modernized drilling operations by installing a modern 28" Super Service upright drill with compound table.

The job shown here consists of drilling and reaming 1" holes in a 4"x4"x2" bearing. Accuracy is held to ±.004".

This user reports the Super Service so easy to handle that it it is a time and money saver on even one and two piece lots. You, too, can depend on "More Holes per Dollar" when you take advantage of the adaptability, productivity, accuracy and ease of handling offered in Super Service Uprights. Available in 21", 24" and 28" All Geared Sizes. *Write for Bulletin U-22.*

THE CINCINNATI BICKFORD TOOL CO.
OAKLEY CINCINNATI OHIO U.S.A.

cloth is offered by Industrial Products Co., 704 W. Somerset St., Philadelphia, Pa., for cleaning and polishing lenses of industrial goggles. The wetting out agent used prevents the lenses from banking with condensation. These cloths are packed in transparent envelopes and can be carried in the goggle case.

Coated Welding Rods Offered by C. I. G.

Two flux coated bronze rods for oxy-acetylene welding have been announced by Compressed Industrial Gases, Inc., 221 N. La Salle St., Chicago, Ill. These bronze rods are coated for their entire length with a compounded flux which is claimed to keep the molten metal in a semi-plastic condition so that the operator can apply the bronze in any position with ease. These rods are listed as No. 400 "Ready-Fluxed" bronze rods and No. 401 "Ready-Fluxed" manganese bronze rods. The bronze rods are designed for application in any type of bronze welding of all metals on which bronze is normally used without the use of additional flux. No. 401 manganese bronze rods are claimed to be particularly suitable for bronze welding of cast iron.

"Showerway" Provides Sanitary Hand Washing

About the size of a small refrigerator, the "Showerway" hand-washing unit offered by Lyon Metal Products, Inc., Aurora, Ill., is a self-contained unit which provides warm water and soap for convenient use. The warm water is released by a foot pedal and the liquid soap is ejected all around the soap plunger, cleaning it each time it is used. The water is held in the unit itself, in a 6-gal. stainless steel tank, and stepping on the pedal releases the water through the showerhead by gravity; there is no force. Therefore, it is claimed that a thorough hand-washing can be had with from 6 to 8 oz. of water.

THIS 200 Ton, Single-Action Drawing Press is **"Engineered to the Job"** by Watson-Stillman. By designing presses for specific purposes, Watson-Stillman is able to help you attain maximum efficiency in production.

The press illustrated was designed for use in drawing cartridge cases for shells.

Presses like this—"Engineered to the Job" by Watson-Stillman—are the result of over eighty-five years devoted solely to the manufacture of hydraulic equipment.

Whenever you need it, this wealth of experience is yours. Have our engineering staff study your problems. Their recommendations will point the way to improved methods that will mean great production economies.

THE WATSON-STILLMAN CO.
107 Aldene Rd., Roselle, N. J.

TRADE PUBLICATIONS

ABRASIVE CUTTING The Andrew C. Campbell Div., American Chain & Cable Co., Bridgeport, Conn., has started to issue a series of "Tip Sheets" discussing new developments in abrasive cutting.

"AUTO-DOPER" A circular describing a new "Auto-Doper" which automatically applies composition to buffing wheels has been made available by Hammond Machinery Builders, Inc., 1618 Douglas Ave., Kalamazoo, Mich.

BEARINGS What happens to new bearings during the running-in period is discussed in a bulletin released by Acheson Colloids Corp., Port Huron, Mich.

BROACHING Bulletin No. 12791, released by the Ex-Cell-O Corp., 1224 Oakman Blvd., Detroit, Mich., illustrates many examples of difficult machining problems solved by broaching.

CORROSION PREVENTION A 12-page illustrated bulletin issued by the American Concrete & Steel Pipe Co., South Gate, Calif., discusses characteristics of the "Amercoat" corrosion proof sprayable plastic coating for protecting concrete, metal and wood surfaces.

CUTTING BARRELS A folder released by the Hartford Steel Ball Co., Hartford, Conn., lists specifica-

tions of a line of triple-action cutting barrels for various tumbling operations.

DIE STEELS A pamphlet now being distributed by the Crucible Steel Co. of America, 405 Lexington Ave., New York, N. Y., provides data concerning specialized high-carbon high-chromium die steels.

DRAFTING MACHINES The Model 77 Universal drafting machine is described in an illustrated catalog published by the Universal Drafting Machine Co., Cleveland, Ohio.

DUST CONTROL Information concerning American assembled type "Dustube" dust collectors is provided in an illustrated circular published by the American Foundry Equipment Co., 317 S. Byrkit St., Mishawaka, Ind.

ELECTRIC HEATER A folder issued by the American Car & Foundry Co., 30 Church St., New York, N. Y., describes the "a.c.f Berwick" low-voltage electric screen heater.

ENAMEL The Sherwin-Williams Co., Cleveland, Ohio, has published a 24-page illustrated report dealing with the "Kem Lustral" synthetic resin enamel.

FANS Emerson Electric Mfg. Co., St. Louis, Mo., discusses features of a line of electric air circulators for industrial applications in a 12-page illustrated catalog, No. X-3358.

FORGINGS A bulletin issued by the American Society for Metals, 7016 Euclid Ave., Cleveland, Ohio, describes a volume, "The Forging Handbook," recently published by the society.

GENERATORS Practical applications of diesel-electric generator sets of 20–80-kw. capacity are discussed in a 12-page illustrated booklet, Form No. 4658, offered by the Caterpillar Tractor Co., Peoria, Ill.

GRILLES A folder offered by the Cornell Iron Works, Inc., 36-20 13th St., Long Island City, N. Y., illustrates various types of rolling and sliding grilles.

LATHE The South Bend Lathe Works, South Bend, Ind., has published a new 32-page catalog, No. 46-B, announcing a new model 9-in. workshop precision lathe.

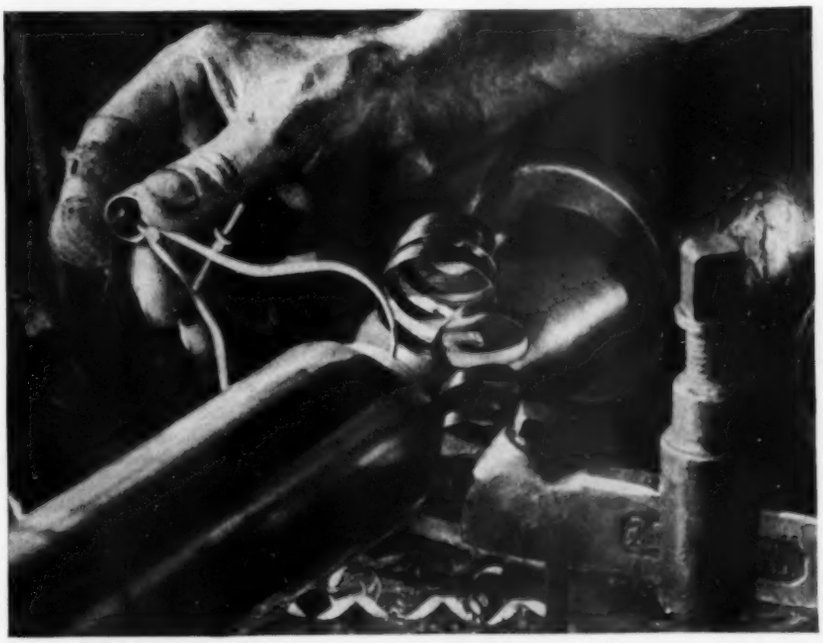
LEADED STEELS A bulletin issued by Joseph T. Ryerson & Son, Inc., Chicago, Ill., includes specifications of a wide range of analyses of lead-bearing, free-machining steels and includes results of actual machining tests.

MICROSCOPES A 32-page illustrated catalog published by E. Leitz Inc., 730 Fifth Ave., New York, N. Y., describes and illustrates the features of an extensive line of binocular prism magnifiers, stereo-microscopes and accessories for numerous technological purposes.

OILSTONES Behr-Manning Corp., Troy, N. Y., has published an oil-stone catalog comprising a reference work on sharpening stones. Aluminum oxide and silicon carbide products are included, as well as many famous old natural stones.

PULLEY The Lewellen Mfg. Co., Columbus, Ind., describes a variable-speed motor pulley in its 12-page illustrated Catalog No. 40.

PUMPS The turbine pump division of Roots-Connersville Blower Corp., Connersville, Ind., has issued Bulletin No. B14-HB, covering a line of horizontal boiler service units for



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Labor costs, rapidly becoming today's No. 1 consideration, are in a measure dependent on materials. On most jobs where steel is used, shop costs are the largest and most variable single factor. While the cost of steel itself is relatively small, the quality plays a very important part in the control of these shop labor costs. If it is hard to fabricate—does not work uniformly—has hard spots to dull or break tools—or in the case of alloys, does not respond properly to heat treatment—then shop labor hours pile up and the job ticket shows red.

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boilers up to 150 lb. pressure and 500 hp. capacity.

RECEIVERS A folder now being distributed by the Ingersoll-Rand Co., Phillipsburg, N. J., includes specifications of an extensive line of receivers for air or gas.

SAFETY An 8-page illustrated booklet, No. CE-8, issued by the Mine Safety Appliances Co., Braddock, Thomas & Meade Sts., Pittsburgh, Pa., discusses a line of goggles, safety spectacles, welding helmets and similar items.

SHARPENING MACHINE The Barber-Colman Co., 155 Loomis St., Rockford, Ill., has issued an illustrated folder discussing features of a combination sharpening machine for reamers, hobs and milling cutters.

SHEAVES Allis-Chalmers Mfg. Co., Milwaukee, Wis., discusses the "Vari-Pitch" line of adjustable V-belt sheaves in Bulletin No. 1261-B.

STANDARDS Miscellaneous Publication No. M-161, issued by the National Bureau of Standards, U.S. Department of Commerce, comprises the report of the 28th National Conference on Weights and Measures. Copies may be obtained from the Superintendent of Documents, Washington, D.C., for 30 cents each.

THREAD GRINDING Bulletin No. 12591, issued by the Ex-Cell-O Corp., 1224 Oakman Blvd., Detroit, Mich., describes and illustrates features of the Styles No. 35 and 36-L precision thread grinding machines.

TOOL STORAGE A catalog illustrating and describing the construction and use of steel tool storage equipment has been made available by Lyon Metal Products, Inc., Aurora, Ill.

TRUCK DIESELS "Dodge and Diesel," a booklet published by the truck sales department, Dodge Div., Chrysler Corp., Detroit, Mich., explains and illustrates features of the diesel engine and compares its operation with that of the conventional gasoline engine.

WELDING Two pocket-sized, 40-page booklets published by the Hobart Bros. Co., Troy, Ohio, illustrate recent developments in the field of welding. One deals with a line of simplified arc welders, while the other outlines the manufacturing technique behind their construction.

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SEEN and HEARD

JOHN R. GODFREY

Light Under a Bushel

A firm owned by one family for several generations has an idea that appeals to the father in us. Whenever anyone in this particular plant adds to the population, a small trust fund in the name of the child is immediately established by the owner of the firm. The fund is of sufficient amount to insure that the child gets a high school education.

Where the Shop Man Counts

Shop men may not count in specifying what machines are to be bought, but they are the final jury that decides whether they work or not. Ran into another case of this not long ago where the boss had been sold on the idea of a band saw for his die shop. He bought one without selling the idea to his men and was having a hard job to get it used.

He couldn't post a notice that it must be used without specifying the

jobs. If he had sold the men on the item they would have found new jobs for it every day—as many others have.

Reviving Fashions and Methods

Fashions are not confined to women's hats. As applied to methods and design they come and go in spasmodic cycles.

Graham used steel balls to burnish the bore in valve guides perhaps fifteen years ago. As I recall there were six guides in each casting and all were "balled" at one shot. It seemed like a good idea but didn't last. Some said the holes were not straight but followed inequalities in hardness of the casting.

The method has been revived by one of the large builders, and no trouble is reported. Perhaps the castings are more uniform. It often happens that early failure of a method was caused by materials or machines, which have since been improved. It behooves "oldtimers" to bear this in mind before predicting as to methods that failed years ago.

Rigging Machines for One Job

Many a job shop has one or more machines that would belong in the junk heap if they had to be used on general work. But when they are set up for some special job that comes occasionally, they are very useful items of the shop equipment.

There may be cases where their room is worth more than their value on a particular job. That is a problem for the boss to add to his other headaches. But age alone is not a safe criterion in declaring a machine obsolete in a job shop. On production, it's a different story.

A Steam Stagecoach

By H. M. LANE

My great grandfather, Comfort Lane, ran a carriage shop at Suffield, Connecticut. Suffield is located on the west of the Connecticut River, between Hartford, Connecticut, and Springfield, Massachusetts. By 1815, when my grandfather, Samuel A. Lane, was born, he had built up quite a business in what were known as thoroughbrace stagecoaches. These coaches had a substantial underframe with four heavy wheels, and at the front and the back, there extended up heavy steel springs. Between the tops of these springs were stretched two straps from the front to the back, and the body of the stagecoach was mounted on these straps.

The combination of the swinging motion and the springs served to reduce the bumps of the road to a great extent. These coaches were generally made with the seats wide enough to hold three people comfortably in each of the two inside seats, and some of them held four. In the thoroughbrace coach, there were generally one or two passengers riding with the driver in the front, but the top of the coach was rarely used for passengers. When the top of the coach was used, a different method of suspension was employed.

He furnished many coaches for the Boston & Albany Coach Line, the Boston-New York Coach Line and other through routes, as well as an extensive local business.

The old family house is still standing though it has been outside of the family for nearly 100 years.

The factory was a long building, or series of buildings, on the west of the road, just north of Suffield Center.

Most of the work in those days was turned out by hand, but they had lathes, saws and drill presses, and later in this shop was set up the

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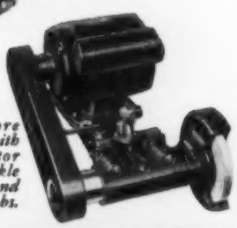

The Dumore "Chief" with 1 h. p. motor built to tackle the biggest and heaviest jobs.

DUMORE
PRECISION GRINDERS

first board drop hammer to be operated in this country.

To run all this machinery, there was a line of wooden shafting running in wooden bearings, located down the center of the shop. At the north end the shaft led through the wall of the building into a shed, and on the end of the shaft was a pinwheel or pin gear which meshed into a large crown wheel or gear, which was mounted in a horizontal position on the top of a vertical shaft. Below the gear there was a bar across the shaft and to this bar horses could be hitched and driven around in a circle, thus forming the horsepower, the amount of power being determined by the number of horses used. Generally two horses were sufficient.

The slow circular motion of the horsepower was multiplied when transmitted to the pin wheel on the end of the shaft, and in the shop countershafts and belting were used to get the desired speeds.

The shop was a place of business, but also a place of discussion. At the end of the shop there was a place where several men could sit down. In those days it was the custom to keep a bucket of hard cider and a dipper on the table near the door, and one of the duties of my grandfather, as a boy, was to keep this pail filled from the large number of barrels in the cellar of the old house.

Great grandfather was locally known as Judge Lane, and many of the prominent men from Hartford and Springfield used to come and sit by the cider pail to discuss current topics, engineering problems, and in fact any live topic of the day.

Out of such discussion grew a plan to make a steam stagecoach. The coach proper was made in grandfather's shop, as were also the following wagon or tender for carrying wood and extra water, and an arrangement was made to pull a standard stagecoach behind the outfit.

The engine and boiler were made in Springfield. From such notes as I have, it was about 1823 that they finally assembled equipment, left the shop, and ran around the streets of Springfield. On the comparatively level ground, and with the fairly good roads to Springfield and around the city, the outfit could go anywhere and could pull its intended load, but the steam pressure carried in the boiler was very low, and so there was not the great reserve starting power which exists in a high pressure engine.

It was soon found out that the fuel consumption, even on rather level country, was so great that it was impossible to pull sufficient fuel in the tender.

With the low pressure carried, the outfit was essentially a one-speed affair, and did not have sufficient power to get up long hills or to negotiate the bad mud holes and chuck holes which abounded in the roads at that time.

For these reasons the outfit never made any cross-country runs, as its constructors had fondly hoped it would, and like a good many other experiments of its kind, the equipment was allowed to stand for many years, unused, before it was dismantled.

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Skilled Worker Shortage

Training apprentices has long been a source of interest and discussion—and is now receiving renewed attention. There should be several sources of supply available with a minimum of training.

Among the army of unemployed must be hundreds with some shop experience, enough at least to shorten the usual training period. What if they are beyond the usual age for training? This may be in their favor

as, being more mature and with a keen appreciation for the possibility of steady work, they are likely to be diligent and loyal. A short training period would make them valuable operators if not all round mechanics.

There are also many trade school graduates who have not found employment in their chosen fields. Many of these have the makings of good mechanics, and with the school foundation, will require far less shop experience than those lacking this background.

Apprentice schools too, might well modify their rule as to age limit for entrance, in cases where young men with evidence of marked mechanical tendencies can be had. In addition we may well consider the experience with vestibule and special schools during the war. Many of these did excellent work in special training in a short period. One excellent feature of these schools was that of re-training in special lines some who had already graduated. There are many men already working in shops who could be made much more valuable to their employers and to themselves with a little intensive training. This would also open opportunities for semi-skilled to replace those who have advanced to better grades of work.

With the likelihood of shortage in skilled workers, no method of increasing the supply, or of increasing the ability of those already at work, should be overlooked.

A Veteran of the Shop

EDWIN KILBURN
Kilburn's Machine Shop

The article by Fred H. Colvin (*AM*—Vol. 83, page 7) reminded me of a lathe which used to be in the first machine shop I ever saw, the old North Star Iron Works of this town.

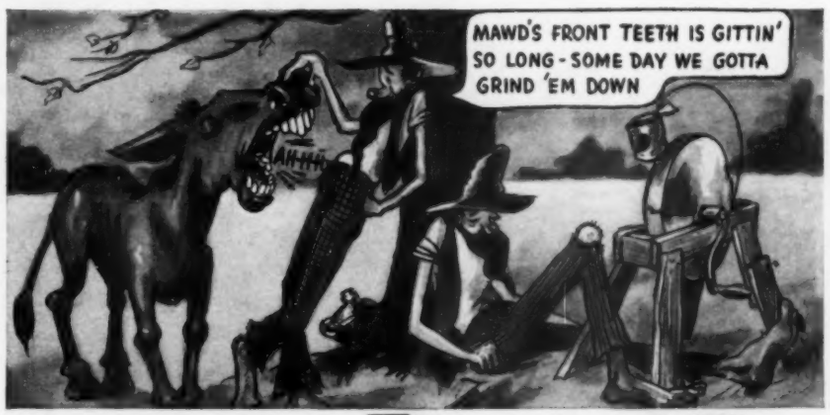
I do not know how old this shop was when I first knew it, but it was a live and going concern in the '80s and, of course, a place of considerable attraction to a young fellow from the country who had never been around machine shops.

One piece of equipment was what I judge was a home-made lathe of between 40 and 48-in. swing. The foundation or bed was of heavy timbers, 10 x 10 in. or heavier; on these timbers were mounted sections of cast iron to form the ways for the carriage and tailstock. I do not recall the length of these sections, but as I remember it, they were around 4 ft. long each, and the lathe was some 12 or 14 ft. long.

The headstock was decidedly of the skeleton type, and in fact, the whole lathe was extremely light according to modern ideas. It was used mostly for turning and boring flywheels for a line of small steam engines.

The other odd piece of equipment was the engine which drove the shop. This engine was located in the boiler room at one end of the shop and was of the type which used to be described as upside down, that is, the crankshaft was overhead and in line with the shop lineshaft to which it was directly coupled. There was a casting for the frame extending from the crankshaft to the floor, the cylinder being bolted to the frame some 4 ft. from the floor. There was one bearing for the crankshaft next to the crank and on the opposite side of the bearing was the eccentric to operate the slide valve and beside it a balance wheel some 3 ft. in diameter. The coupling, which attached the crankshaft to the lineshaft, came next with a bearing close to it on the lineshaft.

Certainly this was a far cry from the modern individual motor driven machine shop equipment, but that shop was a busy one in its day and served a large territory.



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